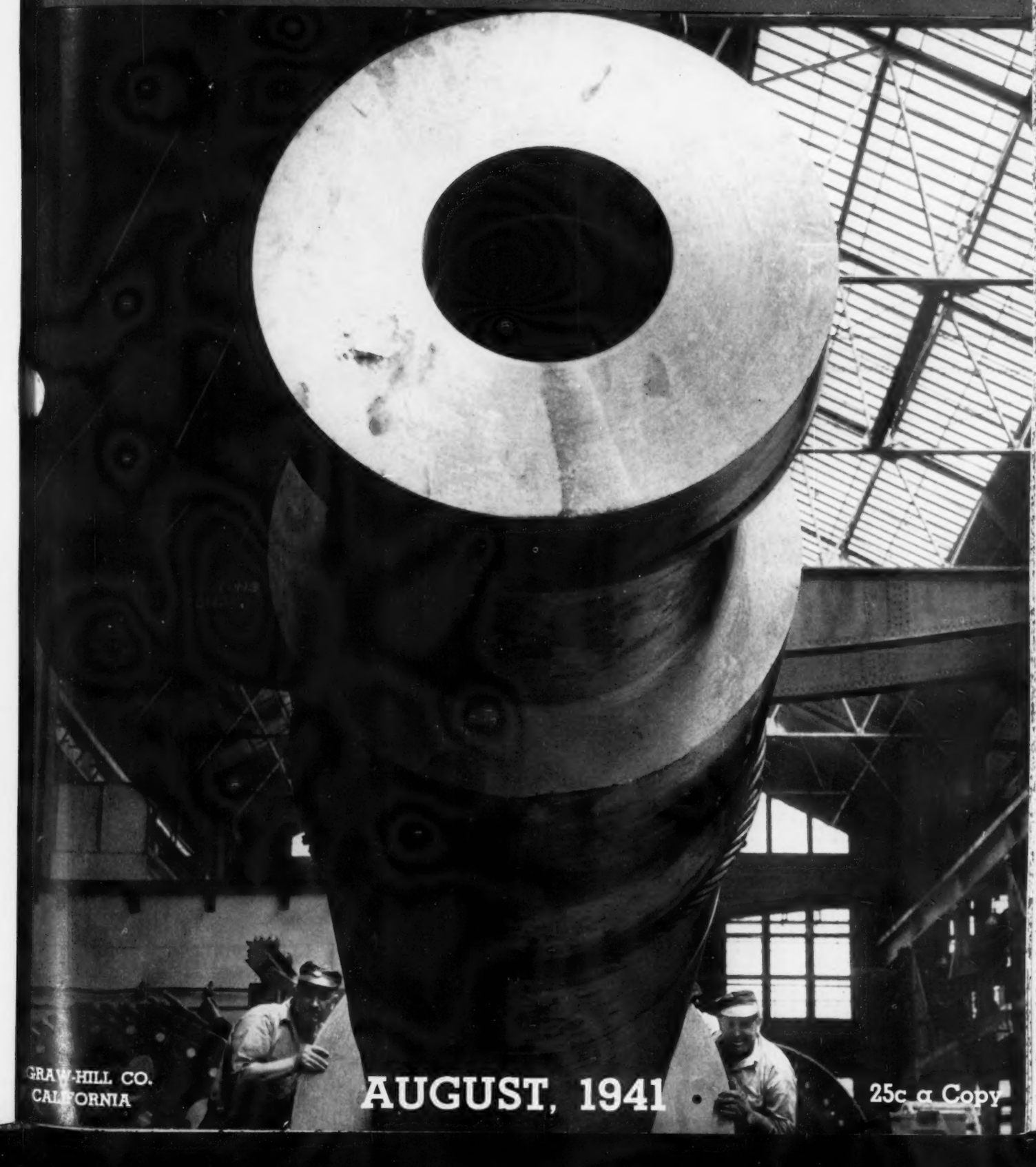
ELECTRICAL WEST

THE ALL-INDUSTRY MAGAZINE OF PROGRESS



GRAW-HILL CO.
CALIFORNIA

AUGUST, 1941

25c a Copy

Honeymoon goes on with
ELECTRIC ROASTER
Now as low as $3 down
Try it Free in your home
SOUTHERN CALIFORNIA EDISON COMPANY LTD.

Two-way economy is yours with a modern
ELECTRIC ROASTER
Now as low as $3 down
See for yourself Free
AT YOUR DEALER OR EDISON OFFICE

Easy to cook anywhere . . . perfectly
a modern ELECTR ROAST
Now as low as $3 down
Try it Free!
SOUTHERN CALIFORNIA EDISON COMPANY LTD.

The purse-easy introduction to electric cooking

★ The electric roaster gives every housewife an opportunity to sample electric cooking with a minimum investment. With her roaster, she satisfies a long-felt desire for the cleanliness, coolness, and better cooking electricity provides. The Edison roaster campaign continues in the newspapers and by direct mail. Tie in with it for greater profit.

SOUTHERN CALIFORNIA Edison

ELECTRICAL WEST (with which is consolidated The Journal of Electricity), August, 1941. Vol. 87, No. 2. Published monthly by the McGraw-Hill Company of California, 68 Post Street, San Francisco, Calif. Entered as second class matter at the post office at San Francisco under the Act of March 3, 1879. Additional entry as second class matter at the post office at Los Angeles. Printed in U. S. A. Subscription rate in U. S. and U. S. possessions, and Canada, $2 per year; all other countries $3 gold (thirteen shillings). Single copy 25c.
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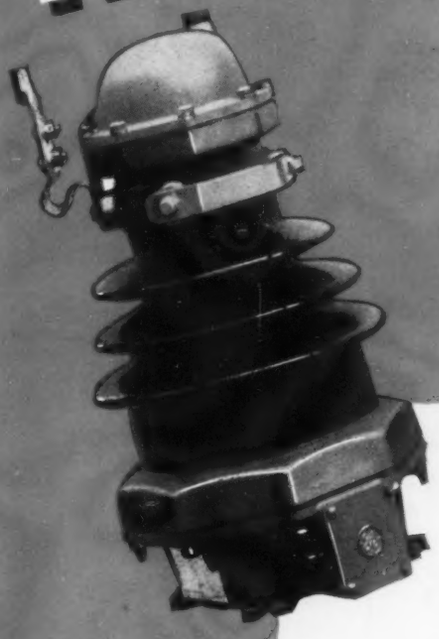
NOW

SPIRAKORE

INSTRUMENT TRANSFORMERS

OUTDOOR C.T.'s — 2 SIZES



Type KF-311
23 kv
(supersedes Type KF-310)

NOTE THESE FEATURES

LIGHTER WEIGHT

23-kv unit reduced 10%
34.5-kv unit reduced 16%

SMALLER SIZE

Both units reduced 3 in. in diam
(34.5-kv unit also reduced 3 in. in height)

PYRANOL FILLED

No fire hazard, no sludge
(also available oil filled)

HIGH ACCURACY

Well within the highest accuracy classification $\frac{1}{4}X$, $\frac{1}{4}Y$, $\frac{1}{4}Z$
Suitable for relaying or metering

Type KF-316
34.5 kv
(supersedes Type KF-315)

THE Spirakore design, so successful in G-E distribution transformers, is used in these new outdoor current transformers. The reductions in size and weight are due primarily to this unique core construction.

These Spirakore outdoor units are of the porcelain-shell type. Their high accuracy under over-current conditions makes them ideal for relaying as well as metering.

Get in touch with the nearest G-E office for more information and assistance in applying these transformers. General Electric, Schenectady, N.Y.

GENERAL ELECTRIC

604-4-6400

PRINT IN BINDING

Here in the WEST

People

F. J. Wellhouse
street and aviation lighting engineer for Westinghouse at San Francisco, spends his days designing lighting installations, his free time in "retreat" at his compact home experimental lab. Taking time from both pursuits, he authored "Lighting Our Skyways" (p. 31) a round-up of aviation lighting problems and progress. A past chairman of S. F. section IES, Wellhouse has been with Westinghouse since 1909.

A. W. Copley
is a University of Kansas graduate whose entire career has been with Westinghouse in various engineering capacities. He has been on the Pacific Coast since 1921, first as district engineer and later as manager of engineering. He is holder of the coveted Westinghouse Order of Merit.

Messrs. Suransky Bedgood, Brentall and Buell
are experts on distribution subjects. Suransky is PG and E assistant engineer of operation and maintenance, a Univ. of Washington graduate. Brentnall is engineer for the Okonite Co., a position held since 1928, following engineering work for Montana Power and Union Pacific. He is a Montana State graduate. Bedgood has been PG and E superintendent at Santa Rosa since 1929. He started initially with the Sierra and San Francisco Power Co. in 1910 as a substation operator. For a time he was with Snow Mt. Water and Power Co. Buell is a 1909 Stanford graduate. After a Westinghouse apprenticeship he went to the Panama Canal as an engineer. He joined PG and E at San Jose in 1911 in the engineering department, where he is now division superintendent.

Preview

Lighting Issue

Expanded in its coverage of lighting applications and methods and keyed to the morale-building and defense needs of the times, the September number will highlight lighting in the West. With the approach of the fall and winter season the campaigns to light up will be pressed and there is always something interesting in the new ways in which light is being applied.

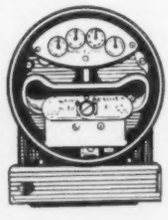
Washers—Ironers

Curtailment of washer and ironer production may come but there has been no let up in sales. Regarded too as essentials and not luxuries washers and ironers are in a preferred class. Sales ideas keyed to the new prob-

lems will be found in the Sales Guide on these appliances next month. The editorial section too will show window display prize winning ideas.

Metering

Cash register for the utility is the meter, whose maintenance and accuracy are matters of extreme importance. Some of next month's engineering discussions will



cover latest developments in equipment, application, testing and repair as applied specifically to Western conditions. One article will feature field testing technique.

Steam

Scheduled for an early issue is a pictorial story on the three 44,000-kw. Pacific Gas and Electric steam plants at Avon, Martinez and Oleum. Drawings and pictures will present the important phases of these stations.

Pages

Lighting Our Skyways 31
By F. J. WELLHOUSE—Standardization and improvements reported in seadrome and airport lighting and radio facilities.

Developments in Distribution Systems 35
By A. W. COPLEY—Economy, efficiency and flexibility are demanded by modern distribution facilities.

Underground Facilities in Small Communities 38
By W. P. BEDGOOD, E. L. BRENTNALL, H. H. BUELL—A PCEA symposium featured at Coronado.

"Out but Never Down" 45
When a utility quits merchandising major appliances, what becomes of its salesmen?

Shooting Trouble on Fluorescent Light 56
By WALTER HESTON—Test procedure using dummy starting switch.

New Products 4
Bulletins, etc. 14
Electra's Husband 28
Engineering 35
Rural 44
Sales 46
Sales Guide 49
Lighting and Wiring 56
Editorials 60
Associations 62
News 70

Cover: Looming up like a giant cannon, a 130,000-lb. shaft for 75,000-hp. Bonneville generator is shown at General Electric works. G-E Photo.

5/8% step regulators give you Narrow Band Widths WITHOUT 200% HIGHER EXCITING CURRENT!

Allis-Chalmers DFR Regulators Easily Hold 2-Volt Bands . . . Yet Need Only 1/3 the Exciting Current Required by Older Types of Regulators.

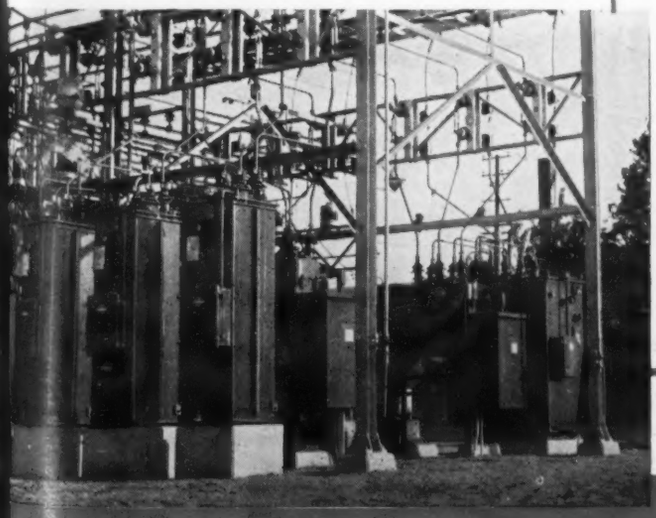
ACTUAL TESTS by utility engineers have proved that Allis-Chalmers 5/8% Step Regulators need *only 1/3 the exciting current required by older types of regulators!* Wattless current is cut 67% . . . more system capacity released for pay loads . . . fewer capacitors needed!

That's one reason why more and more systems are taking advantage of the savings of the Allis-Chalmers DFR — the only station-type step regulator for single-phase, 2400 and 4800 volt feeders on the market today. Here's another . . .

The Allis-Chalmers DFR Regulator easily holds narrow band widths — as low as ±3/4 volts on some feeders. There are no compounding or holding coils . . . the relay is free to follow each voltage fluctuation without excessive damping.

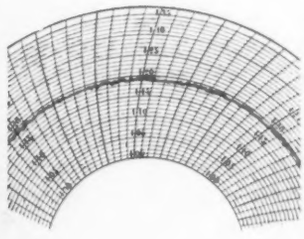
Important, too, are DFR's reduced losses, quieter operation, and minimum maintenance costs — all new standards in feeder voltage regulation.

Why not let an engineer in the nearest Allis-Chalmers district office show you how the Allis-Chalmers 5/8% Step Regulator can bring better regulation at lower all-around cost to your system? Call him today. Or write direct to Allis-Chalmers, Milwaukee, for your copy of Bulletin B-6065. A 1408



On the lines of a southern utility—three 72 kva, 2400 volt Allis-Chalmers DFR's (foreground) and one 216 kva, 4160 volt 5/8% Step AFR Regulator.

5/8% STEP REGULATORS Have Been Holding 2-VOLT BANDS FOR 7 YEARS!



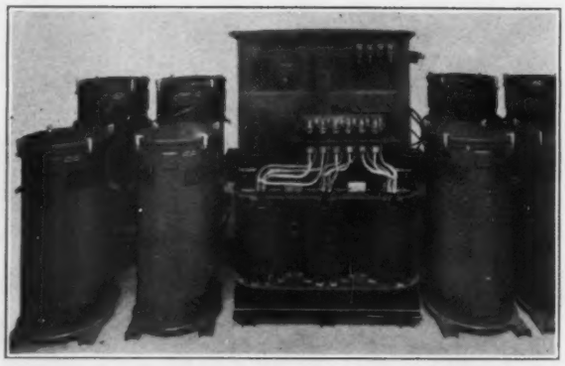
When the Allis-Chalmers 5/8% Step Regulator was designed over eight years ago, the size of steps was selected as 5/8 of 1% because data gathered from utilities all over the country indicated that the 2-volt band was desirable.

A look at the accompanying chart —the actual record during operation on the lines of an eastern system — will show you how the Allis-Chalmers DFR *easily* holds a 2-volt band.

These 5/8% Step Regulators Are Famous for Better Regulation at Lower Cost! Choose the Regulator to Fit Your Purpose!

DFR — 12 to 250 kva, single phase
AFR — 20.8 to 750 kva, three phase
CFR (air cooled) — 36-96 kva, 2400 volt, single phase

ALLIS-CHALMERS
MILWAUKEE · WISCONSIN



Left: Center Air-Cooled Unit is 112½ KVA, 3 phase, 4000 to 120/240 volts—core and coil stands in front of completed tank to show construction. Air-Cooled Transformers on each side of center unit are 25 KVA, 460/280 to 230/115 volts.

Provide for Flexible Operation Use AIR-COOLED Transformers

It is easy to re-arrange production facilities when expanding or modernizing industrial plants, when you install these large GARDNER Air-Cooled Transformers. They can be placed anywhere without requiring transformer vaults which are expensive and also make it difficult to move transformers to new locations. Too, GARDNER Air-Cooled Transformers do not require oil or any patented filling medium which must be obtained and kept on hand.

GARDNER Transformers, sturdily built to your specifications, provide the answer to your voltage problems. Write for full information.

Gardner Electric Mfg. Co.
4227 Hollis St. Emeryville, Calif.

Represented by

MAYDWELL & HARTZELL
INCORPORATED
SAN FRANCISCO - LOS ANGELES - PHOENIX - PORTLAND

Uptegraff TRANSFORMERS QUALITY SERVICE

Standard EEI/NEMA
Type UD
Utility Distribution
TRANSFORMER
1½ to 100 KVA

Every modern feature for the highest performance in Utility Distribution Transformers is designed and built into this Uptegraff unit.

Continuous service, highest standard of engineering practice, and every detail of design worked out to the Uptegraff requirements of "Quality and Service."

Send for Bulletin No. 112, Uptegraff UD Distribution Transformers. Tell us your needs.

R. E. UPTEGRAFF MANUFACTURING CO.
Uptegraff Blvd. SCOTTDALE, PA.
(Pittsburgh District)

PRODUCTS
that are news

Aerial Ladder (800)

A roomy platform designed so that it is always parallel with the truck bed, and ease of handling are attributes of the Oiersch aerial ladder produced by Line Material Co. A lever-operated hydraulic pump elevates the stairway hoist to any desired height, and at

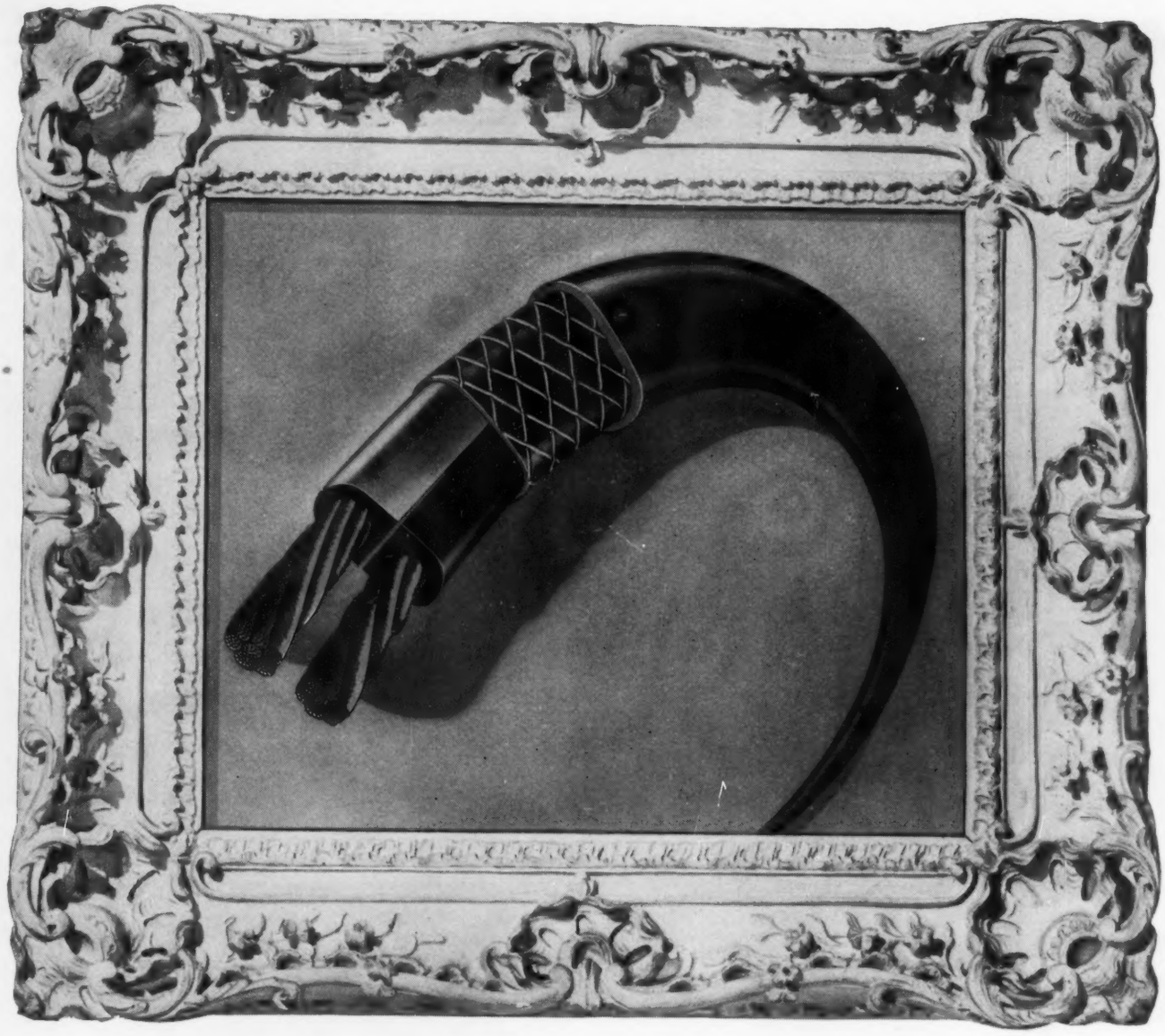
full extension the lineman is enabled to reach points 21 ft. above the ground. The ladder is all welded steel construction, with steps and platform covered with corrugated rubber matting. The steel turntable turns on roller bearings fitted with alemites.

De-ion Interrupter (801)

High interrupting capacity and reduced mounting space are featured in the new non-automatic enclosed "De-ion" circuit interrupter announced by Westinghouse Electric Mfg. Co. To be known as NEMA Type 1A, this sheet steel dust resisting circuit interrupter is designed to replace non-automatic disconnecting devices used in industrial plants, central stations, substations, and locations where enclosed unfused safety switches might be applied. These two or three-pole interrupters have 50 to 600 amp. ratings on 250 to 600 volts a.c. and 125/250 and 250 volts d.c. lines

Branch Circuit Protection (802)

Heinemann Electric Co. has developed a line of service centers for branch circuit protection in apartment buildings, residences and on rural electric lines. Flush and service type cabinets have gray crackle finish over a rust-resisting coating which protects the metal box. The circuit breakers are Heinemann "Magnette" non-thermal type, combining magnetic inverse time delay on harmless overloads with magnetic instantaneous trip on short circuits.



Portrait of a Heliophile*

Ten thousand feet high in the Chilean Andes, you can get an awful sunburn . . . and so can cables. The actinic rays of the sun that high, raise "hob" with cable coverings.

Awhile back, Chile Exploration Company decided they were sick of the hob and gave our research engineers the job of making a cable that could lie in the broiling sun day after day without cracking and failing. So, we made Sunex Securityflex†, a cable that defies the sun ten thousand feet high in the mountains and with equal defiance faces the rough and tumble conditions of mining 3,000 feet below the surface of the earth.

It is an example of the resourcefulness of Anaconda research. It is the same kind of research that produced a great basic advance in paper cable manufacture . . . Type CB† construction that outlasts the standard type by an easily recognizable margin.

The advantages of this research go into every product made by this company . . . and that includes a wire and cable for every electrical requirement. Put them to work for you. There is no premium.

Anaconda Wire and Cable Company
General Offices, 25 Broadway, New York City; Chicago Office: 20 No. Wacker Drive. Subsidiary of Anaconda Copper Mining Company. Sales Offices in Principal Cities.
†Reg. U. S. Pat. Off. 41385

ANACONDA
from mine to consumer

This familiar trademark identifies Anaconda products. It symbolizes the best efforts of man and science.

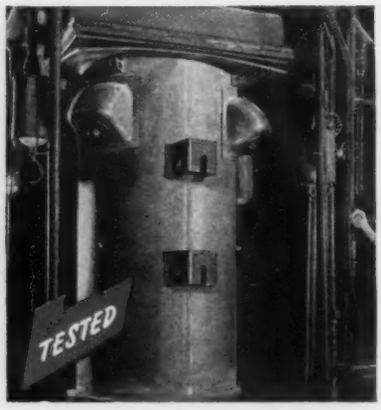
*Borrowed from the Greeks: *helios* (sun) and *philos* (love of)

USE MODERN IMPROVED

ANACONDA WIRE AND CABLE

REASONS WHY ENGINEERS CHOOSE THE NEW

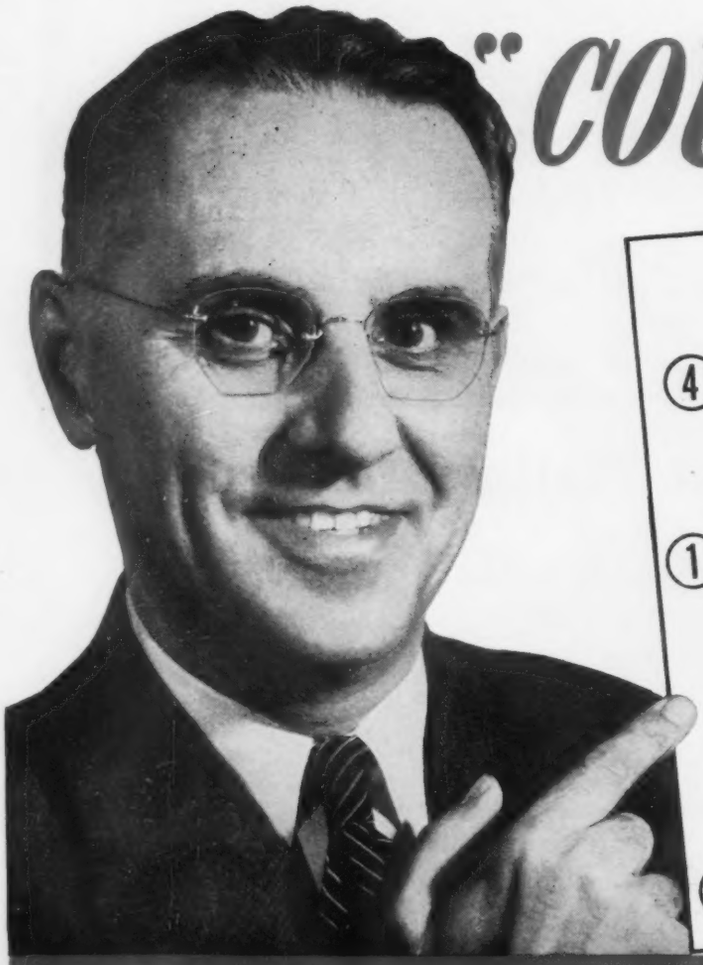
1 Simplified Supports for Direct Pole Mounting Cut Installation Time. Standard Support Spacing and Bushing Location Mean Complete Interchangeability of All Sizes and Makes.

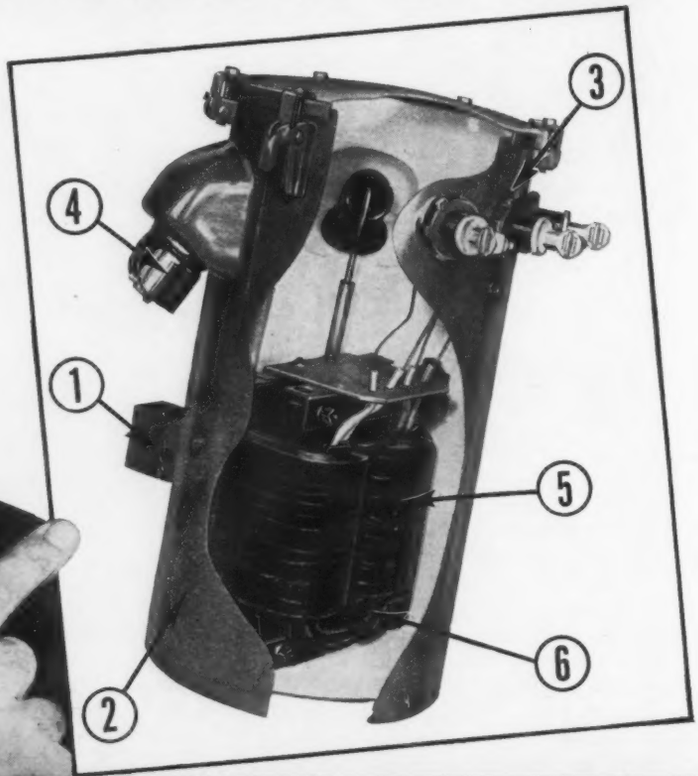


2 New, Durable, Copper-Bearing Steel Tanks. Tested Under Pressures Far Greater than Normal . . . Prevent Oil Leakage, Assure Long Life and Complete Safety.

3 New Spra-bonderizing Process . . . Plus Triple Coat Automobile Finish Give Tanks Positive Four-way Protection Against Attacks of Rust and Corrosion.

"COULDN'T BE



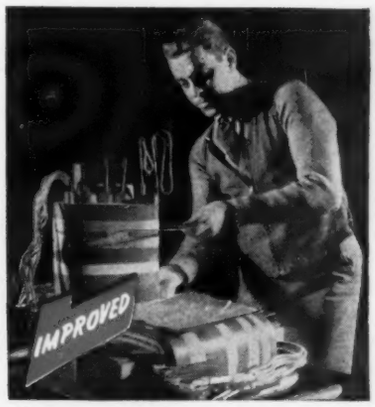


ALLIS-CHALMERS DISTRIBUTION

ALLIS-CHALMERS DISTRIBUTION TRANSFORMER

4 Extra-heavy Porcelain Coordinated Bushings with Liberal Creepage Offer Maximum Reliability Under Fog, Dust, Chemical or Other Adverse Conditions.

5 Double Conductor Insulation... Flexible Enameled Wire... Plus the Added Protection of Well-Lapped Cable Paper Provide Double Safety Against Winding Failures.



6 Improved Core and Coils, Liberally Designed with No Manufacturing Short Cuts . . . Mean Extra Years of Service-free Performance Under All Types of Operating Demands.

BETTER If I Designed It Myself!"

And why not?

That's exactly what you did — for you and other utility engineers all over the country actually "wrote the specifications" for the new Allis-Chalmers Distribution Transformer.

"Your" transformer makes specifying and buying easier . . . permits faster deliveries and easier installation . . . reduces the number of complete units and parts to be carried in stock.

This simplification will undoubtedly save thousands of dollars, not only in first cost, but in operating expenses as well. And it's made possible by standardizing the locations of supports and bushings — all sizes and makes are now completely interchangeable.

But we didn't stop there! Into the manufacture of this new transformer we put all the benefits of advanced engineering . . . plus the best material and skilled workmanship . . . to give you built-in quality that's second to none!

Check the six big engineering features of the new Allis-Chalmers EEI-NEMA Distribution Transformer shown here. Then call the Allis-Chalmers district office near you. Or write direct to Allis-Chalmers, Milwaukee, for your copy of Bulletin B-6159.

A-1412

TRANSFORMERS *Cut Operating Costs*

"We saved a lot of time an' trouble an' concrete"

Chance ROCK ANCHORS require no grouting

There is no need for carrying concrete and mixing materials or lead and heating equipment on the job when anchor installations must be made in solid rock.

With this modern method the only equipment necessary is a rock drill. To install the anchor simply drill a hole by hand or power, drop the anchor into the hole and expand it by turning the rod. The large tripleye admits a bar for use as a wrench. The expanding action wedges the anchor into the hole and the pull on the rod increases the force of this wedge. The Chance Rock Anchor method is definitely a big time, labor and money saver. Installation costs are about 35% less than the old method.

Ask the Chance man or your jobber's salesman for information or a demonstration.

A·B·CHANCE CO. CENTRALIA MISSOURI

Steam Attachment (803)

Proctor Electric Co. has an improved iron which features its "never-lift" action, and a steam attachment consisting of a metal boiler of one quart capacity with an electric heating unit in the bottom Fitting into the top of the boiler is a bakelite cap from which extends a

fabric-covered tube of small diameter. End of this tube is fitted into a steam inlet on the iron. The cap is provided with a steam-escape opening. By means of a pointer control switch, the steam from boiler may be directed into the tube or into the steam-escape opening.

Utility Hottap (804)

Burndy Engineering Co. has designed a hottap suitable for taking taps from either cable or flat bar. Useful for utilities, this connector has a broad field of application in industrial plants, too. It may be used for grounding, temporary taps and jumping equipment being repaired or replaced. The jaws which grip the "hot" conductor have grooved contacts which are designed to clamp cable, and serrated contacts which may be eye clamping element permits connection to used to clamp flat bar securely. Rotatable at any angle.

Silverescent F Line (805)

Graybar Electric Co. has introduced a new line of fluorescent units to be known as Silverescent. They are available either for suspension or ceiling mounting. Emphasized is the diamond shaped reflector paralleling the lamps. The units are die-formed and provide for end-to-end installation in continuous rows. The model 604 F.S. suspension type is a four-lamp, 200 watt unit. Body is 49″ long, 13″ wide and 2″ deep. Length of the bottom of the shield is 26″. The 504 F.C. ceiling type differs only in that it is 12″ wide and extends only 7″ from the ceiling.

ECONOMICAL

Jeffries Transformers

Reasonable in Price
Reliable in Performance

Jeffries large transformers are priced reasonably—and you can save their first cost in a short time by minimizing current losses. When you use a Jeffries transformer, you can provide voltage change at the point desired, without prohibitive expense.

We supply all types and sizes. If not in stock, we build to order in a hurry—a week to 10 days.

Write today for catalog

JEFFRIES TRANSFORMER COMPANY

1710 E. 57th St. Los Angeles, Calif.

Station Pincaps or Posts

..YOU GET

QUALITY

UNITS FROM

O-B

● Two general types of switch and bus insulators are available from O-B—conventional station pincaps and posts. Both are properly designed, thoroughly tested in laboratory and field, and built to the high standards maintained by O-B. Either type has ample flashover values, high puncture strength, adequate cantilever strength, and freedom from radio interference. For ordinary service conditions, neither design is superior to the other, and that leaves you free to choose on the basis of appearance, matching existing units, or preference founded on past performance. Or some particular characteristic like the pin resilience in pincaps to provide for shock loading, the adaptability of pincaps for stacking, the small diameters of posts, or the exposed petticoating of posts may influence your decision. After selecting the proper type, your principal concern is in securing the best insulators available. To get switch and bus insulators of *top quality*—the units which will give the most in performance and life—specify station pincaps *or* posts by O-B.

Buy the Best ...Buy O-B

Ohio Brass

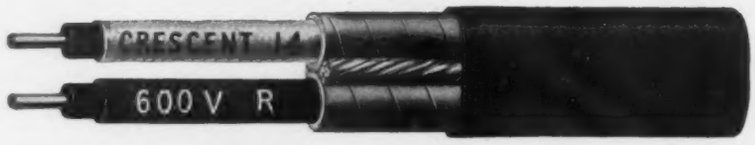
MANSFIELD, OHIO, U. S. A. 8222-M

Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont., Canada

RUBBER COVERED POWER CABLES • BUILDING WIRE

CRESCENT CRESFLEX

NON-METALLIC SHEATHED CABLE



Gives an all-insulated wiring system that is the most suitable where a low resistance water-pipe ground is not available.

Low in cost. Easy and quick to install.

CRESCENT INSULATED WIRE & CABLE CO.

CRESCENT
WIRE and CABLE
Factory: TRENTON, N. J.—*Stocks in Principal Cities*

LOS ANGELES
Tri-State Supply Corp.
544 S. San Pedro St.

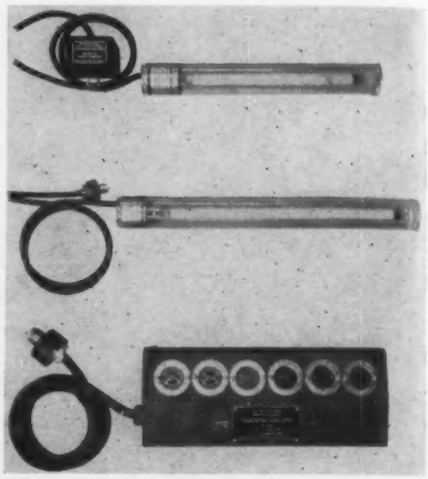
SAN FRANCISCO
Hodges & Glomb
1264 Folsom St.

KANSAS CITY
W. F. Howe & Co.,
2627 McGee St.

CRESFLEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE CABLE • MAGNET WIRE • BARE WIRE

VARNISHED CAMBRIC • FLEXIBLE CORDS • LEAD ENCASED AND PARKWAY CABLES • ARMORED CABLE

CRESCENT ENDURITE SUPER - AGING INSULATION



Trouble Lamp (806)

A fluorescent work light and trouble lamp which has excellent insulation and will not be affected by vibration and high speed machinery use and jars from rough service has been developed by Day-Ray Products. The company intends to fit the unit with a squeeze type rubber bushing where the cord enters the lamp to obtain a vapor proof unit. Shown in the illustration are a 6 in. lamp enclosed in lucite with auxiliary attached to the auxiliary plug. Below, is an 8-in. fluorescent tube and cord in the lucite covering designed to be attached to a gang box shown at the bottom, which also contains the auxiliary. The starter switch in each case is housed in the lucite case. Access to the lamp and switch are had through a lucite screw cap. The lucite makes a very strong abuse-resisting covering and is transparent to all light. The small diameter of the entire lamp permits its use even through small holes and apertures in an airplane wing. The length of the light spreads the illumination to reduce glare.

Conduit Fitting (807)

Kondu Corp. has manufactured a conduit fitting which makes either threaded or threadless connection with heavy or thin-wall conduit. Accomplished by means of interchangeable bushings at the outlets of the fittings, users can now attach either rigid conduit or the lighter tubing using a threaded connection whenever desired. Bushings used for threadless connections, to thick-wall and thin-wall conduit, are similar. Both are slotted to provide for tightening on the conduit, when the retainer nut is turned up. Both have parallel rings inside to grip the conduit and insure good grounding. A third type of bushing, for threaded conduit, has the same outside dimensions as the bushings for threadless fittings, but instead of being slotted is solid, and tapped to take threaded conduit.

Solenoids (808)

A new line of solenoids made by Jefferson Electric Co. comprises a wide range of sizes with strokes. These solenoids are made for continuous or intermittent duty in voltages up to 550 volt, 25 or 50/60 cycles, and up to 550 d.c. for intermittent duty only. Quiet operation is insured by proportioned shading coils and careful grinding of center pole and plunger faces.

Sound Engineering
Finest Materials
Efficient Production
Careful Testing

This is why every L-M transformer is a good buy!

LEFT—UP SIDE DOWN TEST ABOVE—CONVEYOR LINE ASSEMBLY

Each year, every customer-preference survey shows that transformers bearing the name "Line Material" are closer to the top of the list.

The definite reasons for this are: Sound engineering, fine materials, efficient production, careful testing — all the factors of design and manufacture to be found in a modern transformer plant . . . These factors make every L-M Distribution Transformer a good buy, regardless of size, capacity, or type.

The illustrations above tell their own story. In addition to the production methods shown here, there are automatic welders for the tanks, infra-red drying ovens for the paint — ample modern facilities which enable us to build transformers as you want them, built to meet your service requirements.

LINE MATERIAL COMPANY

Supporting Industry

POWER!

QUICK
EFFICIENT
CHANGEABLE
FLEXIBLE

Gorilla Grips

Stock inventory sets including all popular types of connectors. Nuts fit each type and take 19 wire sizes. At finger tips—low investment—convenient.

National Electric
PRODUCTS CORPORATION
1300 Fulton Bldg. Pittsburgh, Pa.

Plastic Reflector (809)

A plastic reflector for street lighting units, made of Textolite, a phenolic-resin compound, has been announced by the General Electric Co. It is rust-and-warp-proof, resists chipping and is lighter and stronger than previous metal types. Covered with Glyptal, an alkyd resin, the plastic reflector has a baked-on finish. Collar of the unit is made of copper, and is constructed to fit standard hood. Reflector is available in standard dome, 20-inch diameter, radial-wave type.

Crisp Control (810)

Featuring a second automatic control which regulates toast crispness, the Proctor Electric

Co. has developed a new automatic toaster with two controls, one for regulating browning of toast and the other for controlling texture.

Enameled Conduit (811)

Triangle Conduit & Cable Co. has available EMT (thin wall conduit) with baked-on black enameled finish, approved by Underwriters. According to the company, this development is brought about because of the shortage of zinc. Hot dip galvanized EMT with baked-on lacquer finish will be produced so far as raw materials will permit.

Combination Disconnect (812)

G and W Electric Specialty Co. announce a new form of type "PG" combination oil brake and air brake subway disconnect. This device provides a full 500-amp., 5,000-volt load break disconnection, of the branch from the straight through main circuit, by means of plug lengths operated by a bakelite insulated handle. The tank is half filled with oil so that the main circuit contacts on top have the extra safety feature of air separation from the branch contacts under oil.

Directional Detector (813)

For use in directional discrimination in the detection of phase and ground faults, a new series of relays is announced by Westinghouse. Although generally installed along with fault detector relays, these types H-3 and HV-3 high speed, three-phase directional relays are also used with frequency relays to trip the tie line breakers on under or over frequency. The full glass cover permits complete visual inspection without removal and a similar construction with plug-in features can be supplied. In case of a system fault which collapses or brings in phase any of the applied delta voltages of the three-phase system, a voltage restraint is removed. Double throw silver contacts permit application to either single line or parallel line protection. The contacts will close 30 amp. at 250 volts d-c, and the auxiliary relay (contact or switch) will safely carry this current long enough to trip the breaker.

Multi-breaker (814)

For use on any normal-duty application that would otherwise require fuses or fused switches, a low-cost multi-breaker has been produced by Westinghouse Electric & Mfg. Co. The unit is available in two types, M-1 and M-2, these are 15 to 100 ampere, 2 or 3 pole breakers are for use on a-c circuits up to 230 volts. The sheet steel enclosure is dust-resisting with 10 concentric knock-outs for conduit or cable connections.

Super Vacuum (815)

Black and Decker Mfg. Co. have perfected a super-powered vacuum cleaner called the No. 95 Vackar for both automotive and industrial use. The unit is powered by a 1-hp. motor driving a 3-stage centrifugal fan, has a sealed vacuum pull of 65 in., and draws 60 cu. ft. of air per minute. With both inlet and outlet hose connections, it can be used as a vacuum cleaner or blower. A system of baffle plates and filters specially adapts this Vackar to wet cleaning and to removing excess moisture after scrubbing upholstery and carpets.

Non-inflammable (816)

Wagner Electric Corp. has a new type transformer known as Noflamol. Noflamol is a non-inflammable synthetic liquid developed as an improvement over regular transformer oil. Because of these non-inflammable characteristics such transformers can be installed indoors without the use of fireproof vaults.

Rotating Cable Clamp (817)

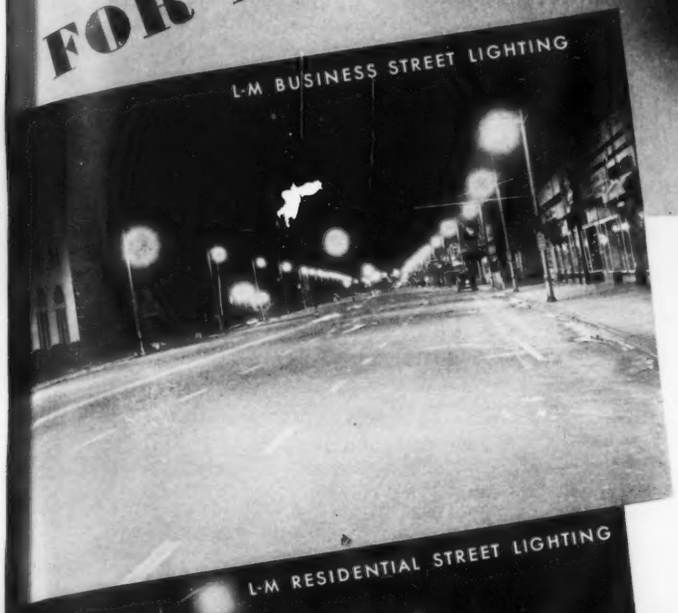
To make cable connections easier and to reduce costs, Burndy introduced Versilug—Type EA electrical connector. A new element is the rotatable cable clamp, which permits conductors to be joined to the connectors at any angle. Each size accommodates a range of conductors and only six sizes are necessary to take conductors from No. 8 stranded cable to 1000 M circ. mil. The connector body is made of high-conductivity copper alloy while the clamping eye is made of high-strength bronze. High-strength Everdur bolts are used to obtain high clamping pressures. There are no exposed threads.

Fading Test Lamp (818)

Keese Engineering Co. have developed a fading test lamp. Known as the Shannon, it is a high intensity mercury vapor lamp with quartz inner burner and special outer envelope of highest transmission. Sixteen 2-in. test openings are provided so that 16 samples can be tested at one time. The outfit is so designed that the lamp socket and holding bracket can be readily taken out of the test housing for use on the outside for individually testing larger samples. This fading test lamp outfit uses 115 watts and the effect with the lamp as designed is from 60 to 100 times that of sunlight, according to the manufacturer.

FOR BUSINESS
FOR APPEARANCE
FOR SAFETY
FOR ECONOMY

L-M LIGHTING



There are many sound reasons why progressive American communities are modernizing their street lighting systems. Business men demand a new White Way for the *prestige* (and for the shopping crowds) good lighting brings to a business street. Thinking citizens organize to obtain the improved visibility that assures greater *safety* for driver and pedestrian. Civic leaders want the distinctive *appearance* that makes streets more pleasing to the eye.

It is significant that the percentage of these progressive communities choosing L-M Street Lighting Equipment grows larger each year. More and more, both the municipal executive and the utility engineer are finding that the complete L-M line of "Everything You Need For Every Type Of Outdoor Lighting", meets every community's requirements, and fits every community's budget.

LINE MATERIAL COMPANY

WESTERN OFFICES • DENVER, LOS ANGELES, OAKLAND, PHOENIX, PORTLAND, SEATTLE, SPOKANE

A Lineman Tells His "Grunt" About KLEIN'S

"Since 1857"

IT'S quality, not luck—not habit—that has put Klein pliers in the hands of linemen and electricians everywhere. The kid starting on line work learns of Klein quality from the "old-timer," who remembers back when he was a "grunt" and first heard that there were no other pliers like Klein's. This "pass along" advice by men who rate tools on their performance under toughest service is a testimonial to Klein's maintenance of highest quality. Unfailing "since 1857."

Your copy of the Klein Pocket Tool Guide will be sent on request.

ASK YOUR SUPPLIER

Foreign Distributor:
International Standard Electric Corp., New York

Mathias KLEIN & Sons
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3200 Belmont Avenue, Chicago, Illinois

BULLETINS

data books, etc.

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Your being right up-to-the-minute may have an important bearing on your success. New developments are appearing daily in your field—tools to help you do a better job. Are you abreast of them? You fall back a step when the other fellow is well informed about a subject of which you are ignorant. Manufacturers' publications are a quick, efficient way for you to keep posted on current events in your field.

Isn't it a bargain to invest 1c (the cost of a postcard) to help earning power to which you look forward? American industry is offering a remarkable service—free. ELECTRICAL WEST makes it easy for you to enjoy this service for your own. Check and mail the coupon below. That's all you have to do to help yourself toward better performance and greater rewards.

Insulating Materials (819)

A 60-page catalog containing full information on the entire G-E line of insulating materials has been published by the glyptal and insulating materials sales section of General Electric appliance and merchandise department. The catalog list prices and describes many items, including different varnished cloths, varnishes, glyptals, tapes, cords, sleever, varnished tubings, mica materials, wedges, and soldering materials. Technical data has been included in the book, dealing with manufacturing processes and tests, and many are illustrated.

Switchgear Equipment (820)

Allis-Chalmers Mfg. Co. has printed a comprehensive new Metalclad Vertical-Lift Switchgear bulletin giving complete coverage of modern switchgear equipment for application wherever electricity is used or produced. This illustrated, 24-page bulletin portrays special construction features of company's line and includes a large number of installation views, as well as dimensions, outline drawings and circuit diagrams.

Suspension Insulators (821)

Suspension type insulators used principally for dead ends and other strain positions on distribution lines are described in a new 9-page leaflet published by Westinghouse Electric and Mfg. Co. Insulators with diameter ranges between 6 and 12 in. are discussed. Design and construction details are given with special emphasis on mechanical stresses. Cutaway sketches illustrate all styles and give physical dimensions. A typical cross section view is shown with principle parts itemized. Complete data for each style are tabulated.

Wallamp Fixtures (822)

La Salle Lighting Products, Inc., has available a new Wallamp catalog on its line of indirect lighting fixtures. A special nail hanger and two-tone finishes are features of the new line.

Dye-Vat Control (823)

A bulletin describing the experience of a user of an automatic dye-vat control system of Bristol Co. has been published. According to the bulletin, ten benefits from this system of control are briefly outlined. It is liberally illustrated and the various Bristol instruments available are listed showing their applications in the textile industries.

Story of F (824)

Fluorescent lighting is the general subject of a 28-page booklet published by General Electric's lamp department at Nela Park. Large illustrations and short descriptive copy cover: benefits of G-E Mazda F-lighting; relation of light to task and eyes; increased production and reduced spoilage; light, visibility and brightness meters for measuring illumination; lighting levels needed for common production tasks; general and supplementary industrial lighting; mercury and filament lighting and drying lamps; typical factory lighting units and certified Fleur-o-lier fixtures.

Welding Positioners

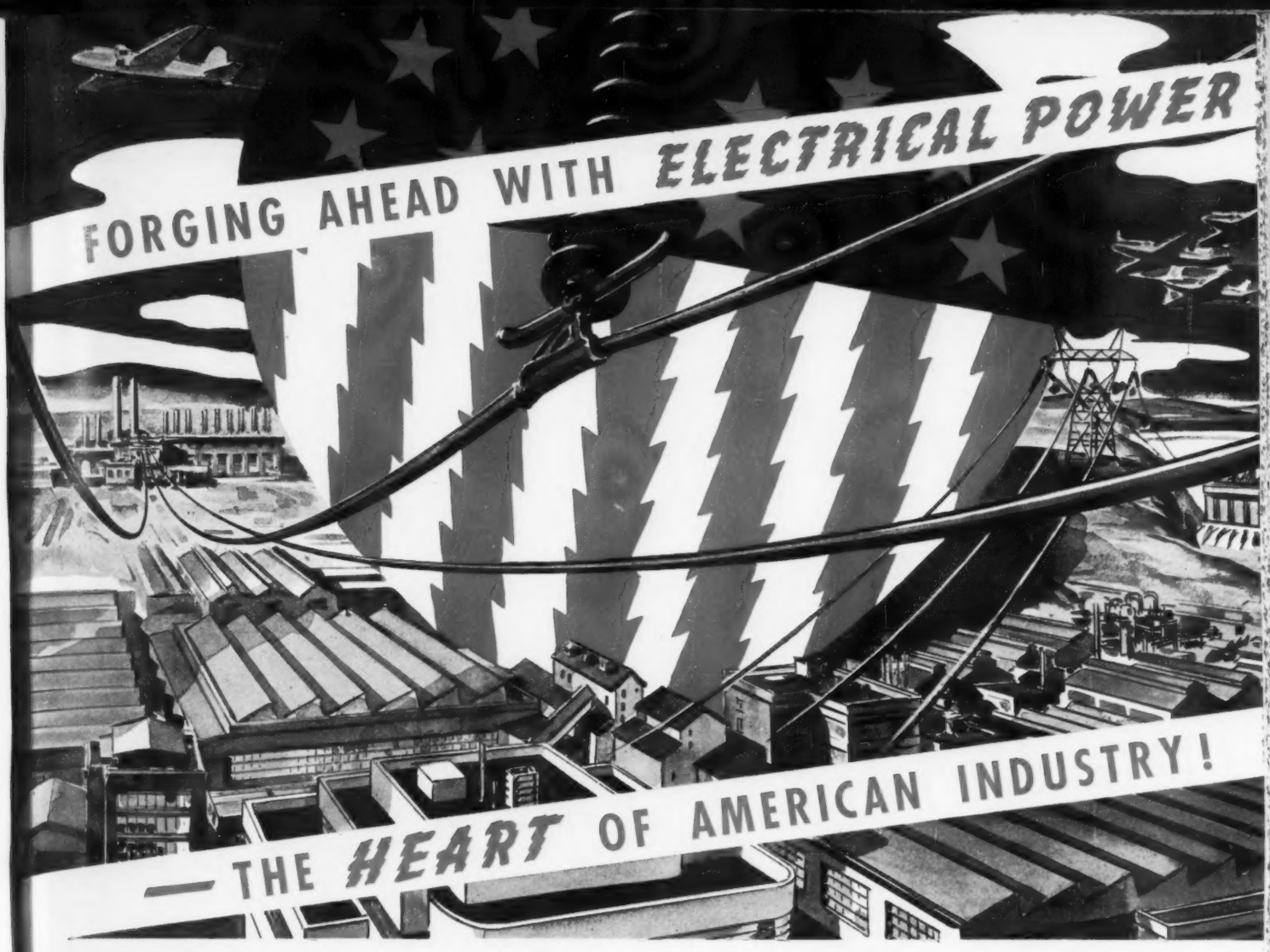
A new bulletin illustrating and describing improvements in 3 and 8 ton capacity welding positioners has been issued by the industrial division, Ransome Concrete Machinery Co. The bulletin is devoted in part to a comparison between ordinary welds and position welds, illustrating both. It provides a table showing the time required for each type.

Insulating Varnishes (825)

Irvington Varnish & Insulator Co. has published a 34-page manual on insulating varnishes which features results of extensive research on insulation applications. According to the company, the purpose of the book is to assist in the proper selection and application of insulating varnishes and all varnishes usually required are described in sequence based upon their relative importance. Subject matter includes description of 31 varnishes, paints and enamels, giving the characteristics, uses and applications and types. The booklet is illustrated with 38 pictures and charts and useful tables including a cross index for reference.

F Line Detailed (826)

DayBrite Lighting Inc. have available three new bulletins on their various fluorescent units. F-47 lists a complete line of troffers in a variety of sizes to fill installation requirements. F-48 covers the kingsway, a new series of glass enclosed type fixtures for direct ceiling mounting available as units, 2, 4, 6 and 8-ft. long and in continuous lengths. F-49 describes the daylume, a new development in plastic, providing efficiency in a series of suspension and ceiling type units for 40-watt to 100-watt lamps. The bulletins each feature exceptional drawings of the fluorescent units together with specifications of their electric requirements and installation measurements.



THE WHEELS OF INDUSTRY are kept smoothly humming by the constant, unfailing flow of electrical power. Metals and materials are being rapidly converted into usable tools, machines and equipment by this tireless, never-ending source of industrial energy. As a result, American production is steadily forging ahead, hour after hour and day after day, with electricity leading the way.

To maintain this uninterrupted flow of generated power over transmission and distribution lines requires carefully engineered pole line hardware that's built to last. That's why Hubbard Hardware has been and will continue to be so widely adopted and used. Just as industry relies on electrical power—electrical power, in turn, places its reliance on Hubbard products and service. Hubbard, too, is constantly forging ahead, keeping abreast of electrical pole line needs.

HUBBARD HARDWARE INCLUDES

- *Standard Pole Line Hardware*
- *Cable Material for Overhead and Underground Construction*
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- *Electric Railway Hardware*
- *Insulator Pins*
- *Pole Top Fixtures and Steel Cross Arms*
- *Strain Insulators and Clevises*
- *High Tension Material*
- *Secondary Racks and Accessories*
- *Pole and Cross Arm Brackets*
- *Wireholders and House Brackets*
- *Expansion Bolts*
- *Street Lighting Equipment*
- *Lightning Arrestors*
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DID YOU KNOW

this costs no more

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—than this old way?

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FIGURE the time it takes to do a serving or mousing job the old way . . . Figure the damage of rust and corrosion caused by nicking galvanizing on the strands . . . Figure hazards of frayed or broken strand ends . . . Add them together and you'll find it pays to serve-up strand ends more safely and neatly by using modern Kearney Guy Wire Clips or Strand Bands.

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UTILITY EQUIPMENT

for BETTER Construction

Secondary Transformers (827)

An illustrated 16-page bulletin on transformers for secondary a.c. network systems has been issued by the Allis-Chalmers Mfg. Co. The bulletin covers equipment especially suited for use in congested urban districts having high density loads. It includes not only outline sketches, installations and shop assembly views, but many construction details of both standard and special network transformers.

Bull Dog Equipment (828)

Bull Dog Electric Products Co. has issued a complete catalog of all of its equipment including safety switches, service equipment, lighting panels, circuit master, and other circuit breaker panels, safety fuse panels, switchboards and miscellaneous devices. Illustrations of the various products, including description and specification schedules and schematic diagrams, are included.

Portable Substations (829)

Projectors rated at 3,000,000 candlepower for determining the height of cloud strata or ceiling above airports are described in a Westinghouse Electric and Mfg. Co. leaflet. Application and construction details cover the projector, mounting bracket and directional beacon. Reflectors, mounting and types of lamps are also discussed.

Triplex Transformers (830)

Triplex transformers—3 single-phase transformers in a common tank—for improved appearance and conservation of space on a distribution line, are described in a new 4-page illustrated leaflet published by Westinghouse Electric & Mfg. Co. Installation photographs show how the Triplex transformer, available in ratings up to 150 kva. and up to 13,200 volts, betters the appearance of the conventional 3 single-phase transformer installation. A diagram on page 3 of the bulletin gives the comparison of floor space occupied by a Triplex, one 3-phase, and one single-phase units. In addition to insuring an unobtrusive installation and saving up to 66% of the floor area required by separate single-phase units, this transformer is designed for easy installation and quick line connection, as outlined in this new folder.

Oil-Circuit Breakers (831)

Oil circuit breakers of 25,000 kva. interrupting capacity for indoor service are described in an 8-page bulletin of Westinghouse Electric and Mfg. Co. The breakers may be installed on lines up to 600 amp., 7500 volt and 800 amp., 5000 volt. Other features described are the de-ion interrupter arcing contacts and wound Micarta terminal bushing. Illustrations show positions of all important parts.

Silex Features (832)

Silex catalogue illustrates, describes and gives prices of the new Silex glass coffeemakers. Diagrammatic view of a Silex, showing the main features for the benefit of dealers selling the line is included in the new catalog.

Primary Fuse Cutouts (833)

Primary fuse cutouts for outdoor use on distribution transformer installations are described in a new 4-page leaflet announced by Westinghouse Electric & Mfg. Co. Distinctive characteristics of these expulsion type fuses with ratings up to 100 amp. at 7500 volts are discussed and operation and construction details are described and illustrated. A table of standard ratings and style numbers facilitate ordering and bracket styles giving physical dimensions and arrangement are also tabulated.

EASY WAY TO GET INFORMATION

To keep posted, simply circle the items in which you are interested, cut out the coupon (it can be pasted on the back of a postcard) and mail to:

ELECTRICAL WEST, 68 Post St., San Francisco, California
Please send me the following CIRCLED items:

800	801	802	803	804	805	806	807	808	809	810
811	812	813	814	815	816	817	818	819	820	821
822	823	824	825	826	827	828	829	830	831	832
833										

Name . . . . . Company* . . . . . Title* . . . . .

Address

* Please include your company's name and your position, as we cannot ask manufacturers to furnish literature unless you do.

When you need SPEED, *this* PACIFIC ELECTRIC BREAKER CLEARS IN 5 CYCLES!

WILL AUTOMATICALLY RECLOSE IN 20 CYCLES

●

Spring-stored Energy

—IS INSTANTLY AVAILABLE TO OPEN AND RECLOSE

When special requirements demand *high speed*, Pacific Electric Breaker, Type RWE 115-kv., can be supplied to clear faults in 5 cycles and reclose in 20 cycles.

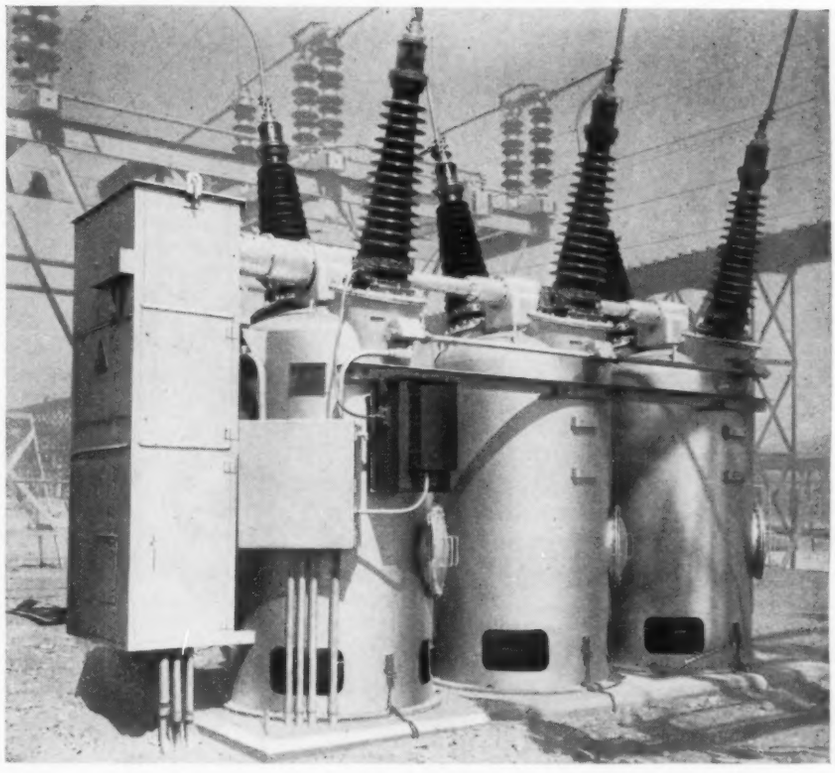
That's because of *spring-stored energy* in the Motor Mechanism, the six Expulsion Chambers per pole which *extinguish arcs rapidly* and other outstanding features.

Energy for openings and reclosings is stored in strong springs wound by a motor operating from low current, permitting small batteries and small leads. Or it operates on alternating current without complicated, short-lived rectifiers. The springs may be hand wound, then *easily released* for high-speed opening or closing. You save on first-cost, save on installation cost, have great reliability and easier synchronizing.

Control parts stay in alignment ending frequent adjustments, for the sturdiness of the Group-Control Mechanism with the Bevel-Link Drive are other features which assure long *trouble-free service and low maintenance.*

You get thorough testing, great mechanical strength, liberal safety factors and our 35 years' experience assures *utmost safety* during operating conditions.

For metering purposes, our high-accuracy Bushing Type-CP Current Transformers are available.



Type RWE, 115-kv. Pacific Electric Oil Circuit Breaker, installed in Montana, which clears faults in 5 cycles and recloses in 20 cycles. 600-a., 1,000,000-kva., MH-4 Motor Mechanism.

Get all the facts on the extra speed, clearing in 5 cycles and reclosing in 20 cycles, of this and other sizes of Pacific Electric Breakers. Study the *reliability* of the *spring-stored energy* of the Motor Mechanism. Then you will know why many utilities send us repeat orders for Pacific Electric Breakers.

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G. B. Kirkwood, 437 S. Hill St., Los Angeles, Calif.
Northwest Supply Co., 909 E. Second St., Butte, Mont.
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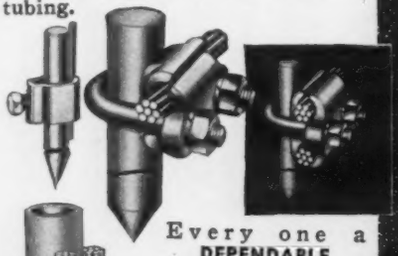
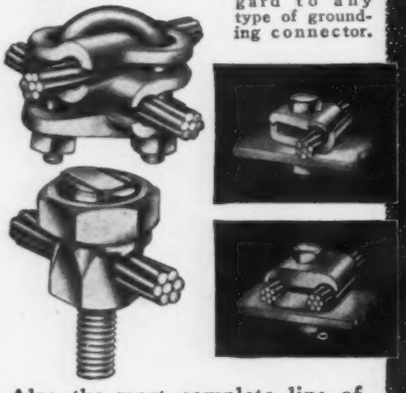
The MOST COMPLETE LINE OF
Grounding Connectors

These pictures can only give you an idea of the variety, because —
Penn-Union makes ALL good types. A complete line of clamps, studs and connectors for all applications. For all combinations of pipe, rod, flat bar, cable, braid, tubing.



Every one a **DEPENDABLE** unit of protection for personnel and equipment — of ample capacity, high mechanical strength, and resistant to corrosion.

Write us in regard to any type of grounding connector.



Also the most complete line of Service Connectors, Cable Taps, Terminal Lugs, Tees, and other fittings. *Penn-Union is the choice of leading utilities and industrials, contractors, and manufacturers of electrical equipment.*

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MAGAZINES
in quick review

In "Priorities for Dealers", *Electrical Merchandising* for July advocates a policy among manufacturers of concentrating their distribution through regular electric appliance dealers and correcting many of the ills of distribution through the so-called discount houses, wholesale catalogue houses and other marginal retailers existing only by offering cut prices. An opportunity to clean up a bad mess should be made under the pressure of appliances shortages.

☆

Gadgets "To Tell the Voltage Story" in July *Electrical Contracting* reviews the various clever devices so far produced to dramatize the necessity for adequate wiring. Same issue contains an article on wiring fluorescent controls and a strong editorial on the rubber covered wire situation.

☆

Wholesaler's Salesman for July contains a series of articles on the possibility of selling various electrical protection systems such as lighting, electric eyes, intercommunication and telephone systems, time switch controls and signaling to stop the saboteur electrically. An article by J. Edgar Hoover, head of FBI, heads the series of articles.

☆

"What Price Highway Lighting", by Elmer F. Anderson of Portland General Electric Co., heads a list of articles on lighting in the July *Electric Light and Power*. Design and cost figures as well as accident statistics on Oregon highways are contained in the article.

☆

"We Like to Cook in Summer if the Kitchen Is Cool" is a brightly treated pictorial article in the August *McCall's* magazine. Electric ranges are featured throughout.

☆

Qualified Contractor, publication of NECA, for July, celebrates the 40th birthday of that association. A history of the Association is interesting. Many westerners have been members since early days.

☆

"The Electrical Contractor's Contribution to Progress" by Clyde L. Chamblin, president, San Francisco Bay chapter NECA, appears in *Qualified Contractor* for June, p. 16. Full text of the talk given at the Coronado convention of PCEA is published.

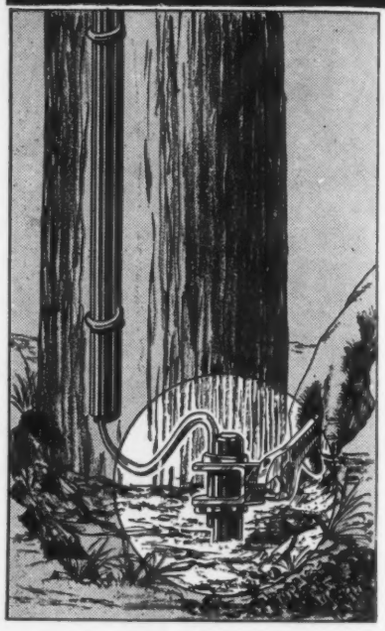
☆

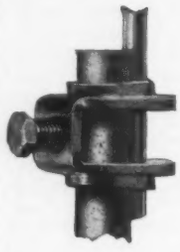
"Lighting Principles and Practice—a Bibliography of Papers Dealing with Lighting Application" appears in the May issue of *Illuminating Engineering*, the IES Transactions. The bibliography classifies a selected list of papers and reports published in the Transactions since 1920 in offering the services and research data of the society to the national defense effort.

☆

"Philadelphia Electric Wins Award for Sales Achievement" in the June 15 issue of *Sales Management* presents some costs and percentages for load building that will interest sales managers of other utilities by comparison to their own.

modernize
YOUR DISTRIBUTION PRACTICE—





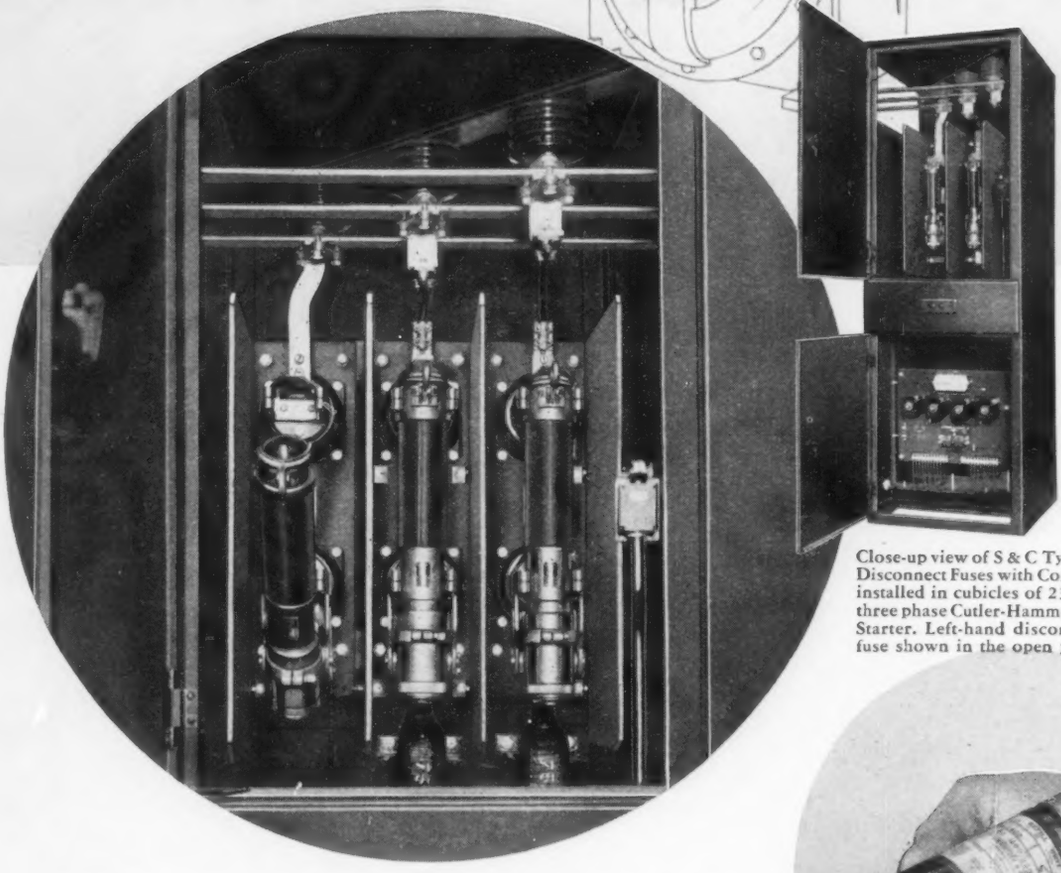
RELIABLE GROUND ROD CLAMPS

Still out in front.

The first low price efficiently designed Ground Rod Clamp still offers a fine thread screw to apply a really high pressure joint. Everdur material throughout, and a body that springs slightly under stress so it will not vibrate loose. Hollow head set screws when specified.

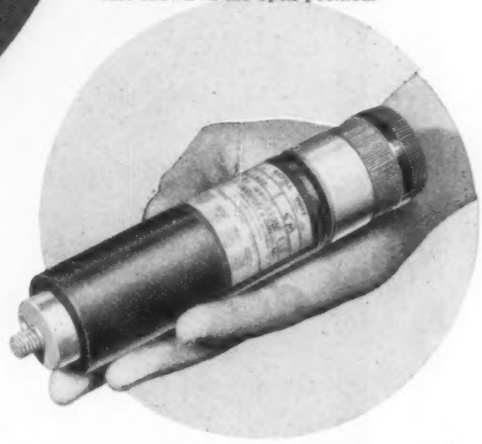
Reliable ELECTRIC COMPANY
OVER 30 YEARS SERVICE TO THE UTILITIES
3143 CARROLL AVENUE · CHICAGO ILLINOIS

S&C TYPE "SM" FUSES FOR..
High Voltage Polyphase Motors



Motor Control section of switchboard (2300 Volt Motor Starter) in paper plant; with S&C Type "SM" Fuses in upper section.

Close-up view of S & C Type "SM" Disconnect Fuses with Condensers installed in cubicles of 2300 Volt three phase Cutler-Hammer Motor Starter. Left-hand disconnecting fuse shown in the open position.



Refill Units are easily removed or replaced in fuse holder, on the job.

● In the C-H 2300-Volt Full Voltage Motor Starter illustrated, oil-immersed contactors are employed for starting and S & C Type "SM" Fuses for short-circuit protection. This combination often provides all necessary functions at a fraction of the cost of other types of switching and protective equipment.

Type "SM" Fuses have the high interrupting capacity and ruggedness to provide protection where short circuits up to 40,000 amps. r.m.s. might occur.

The arc is interrupted in the refill unit tube, which is lined with a solid arc-extinguishing material. The Refill Units, containing accurately calibrated fusible elements, are easily replaced *on the job.*

For use in confined spaces—cubicles, cell structures—"SM" Fuses with condensers eliminate external discharges.

The oil-immersed contactor is built to stand up under frequent motor starting and stopping operations, and it requires relatively little maintenance.

Type "SM" Fuses are made in voltage ratings from 7500 to 34,500, —in current ratings from 1 to 400 amperes. Write for Bulletin 200-E. Consult the nearest S & C representative when you have a high voltage motor control and short-circuit protection problem.

TYPE "SM" FUSES

SCHWEITZER & CONRAD, INC.
4435 Ravenswood Avenue • Chicago, Illinois

WESTERN REPRESENTATIVES:
SAN FRANCISCO — George E. Honn, 420 Market Street
LOS ANGELES — Farnham & Cunningham, Edison Bldg.
SEATTLE — T. S. Wood, 220 Ninth Avenue, North
SALT LAKE CITY — Riter Engineering Co., Kearns Bldg.

LOW POWER FACTOR?

USE FAST CAPACITORS

TO IMPROVE VOLTAGE REGULATION
REDUCE FEEDER LOSSES
RAISE THE POWER FACTOR OF THE SYSTEM

Easy to install, reliable in service the FAST Dust-Tight Unit is neat, sturdy, compact.

The unit is complete with fuses, discharge resistors, conduit box, knock-outs and mounting brackets.

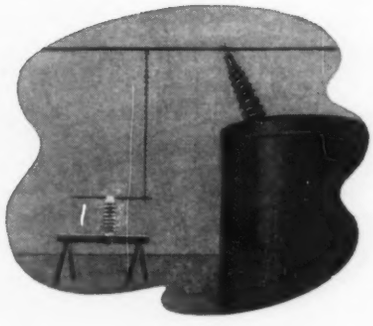
The double container construction is a special feature.

JOHN E. FAST & CO.

CAPACITOR SPECIALISTS FOR 22 YEARS

3123 NORTH CRAWFORD AVENUE CHICAGO, ILLINOIS

West Coast Representatives: WALTHAM, DE WITT & KRUSI, 630-632 Monadnock Building, San Francisco, California



As an engineering conception, the Lapp Post offered performance characteristics superior to any other high voltage insulator design. In ten years it has proved its practical ability to deliver every advantage originally offered in theory.

Lapp

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PEAK PRODUCTION CALLS FOR *Continuity* AS WELL AS SPEED!

The WESTON (Model 430) Maintenance Tester

Built for active maintenance . . . extremely compact, rugged, and with *enduring* precision. Extra large openings with hand calibrated mirror scales insure quick, accurate readings. Available in AC and DC instruments and single phase wattmeters. Inexpensively priced.

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Measures fluorescent, mercury-vapor, incandescent and all other types of lighting *direct* . . . without correction factors. Equipped with the WESTON VISCOR filter . . . a stable, all-glass filter which corrects for all types of lighting regardless of color composition. Saves time, eliminates errors in testing. Available in models for shop and laboratory requirements.

Here are the tools industry is using to help keep motors and machines constantly in fighting trim; forestalling costly breakdowns and work interruptions, eliminating power losses . . . *and*, because of their simplicity, broad utility and dependable accuracy, cut precious hours from the usual testing routine. Weston Electrical Instrument Corporation, 577 Frelinghuysen Ave., Newark, New Jersey.

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Provides the quickest, simplest means for testing electrified equipment regularly . . . thus insuring efficient, uninterrupted operations. The clamping jaws are simply closed over the conductor or bus-bar, and current reading taken. Circuits are never disturbed . . . work never interrupted. Has 6 AC current ranges for maintenance needs.

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With 27 carefully selected voltage, current and resistance ranges, Model 785 handles "trouble" in the most efficient, practical manner. With DC voltage sensitivity of 20,000 ohms per volt, it is ideal for testing sensitive relay circuits, signal and telegraphic systems, photocell circuits, alarm systems, etc. . . . also for testing small motors and controls, lighting circuits, etc. Can also be used with current transformers and voltage multipliers.

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Specialized Test Equipment . . . Light Measurement and Control Devices . . . Exposure Meters . . . Aircraft Instruments . . . Electric Tachometers . . . Dial Thermometers.

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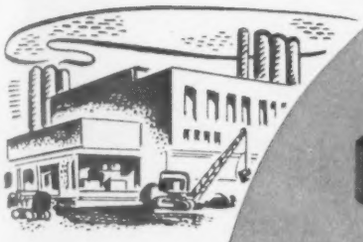
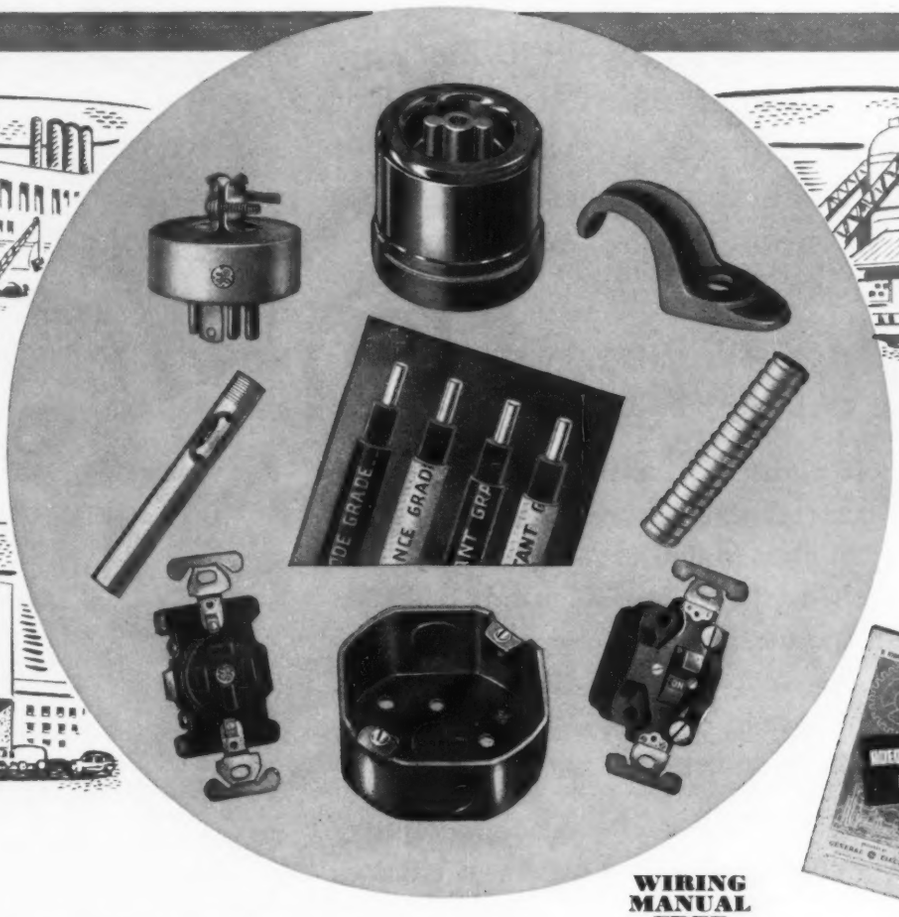
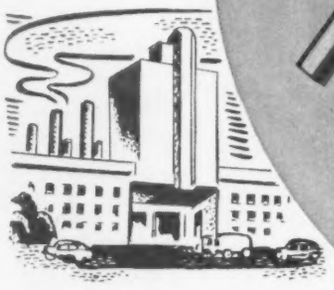
for Today's Needs







YOU'LL find exactly the right wiring materials for new wiring systems, for modernization work, and for maintenance in the G-E line. These materials are conveniently available in your territory, too. G-E Merchandise Distributors are located at all key points in the country.

G-E wiring materials all have the same uniform high quality and are designed to be used together and to give enduring service. The line includes conduit, wire and cable and wiring devices.

WIRING MANUAL FREE

General Electric has prepared a manual called "Adequate Wiring for Industry" which describes modern wiring methods and materials. You'll find it helpful in checking and planning industrial wiring. The manual interprets wiring in terms of savings and service.

For a free copy of this manual and for further information about G-E wiring materials see the nearest G-E Merchandise Distributor or mail the coupon.

GENERAL ELECTRIC

General Electric Company
Section CDW-1188
Appliance and Merchandise Dept.
Bridgeport, Conn.

Sirs: Please send me free a copy of "Adequate Wiring for Industry" with information about G-E Wiring Materials.

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Accuracy of dimensions
Great Mechanical and di-electric strength
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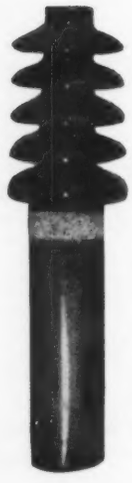
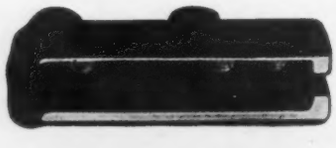
ILLINOIS PORCELAIN

The Illinois plant has the necessary flexibility to meet customers' porcelain needs . . . from the very smallest to the largest sizes. Because of the high quality materials used, ILLINOIS Porcelain products are uniform, insuring ease of assembly. Cooperation by ILLINOIS experts is given on special designs. We give immediate attention to your inquiries.

Specify ILLINOIS Porcelain for dependability and economy. Send today for latest catalog.





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TOP QUALITY · · · EXACT DIMENSIONS

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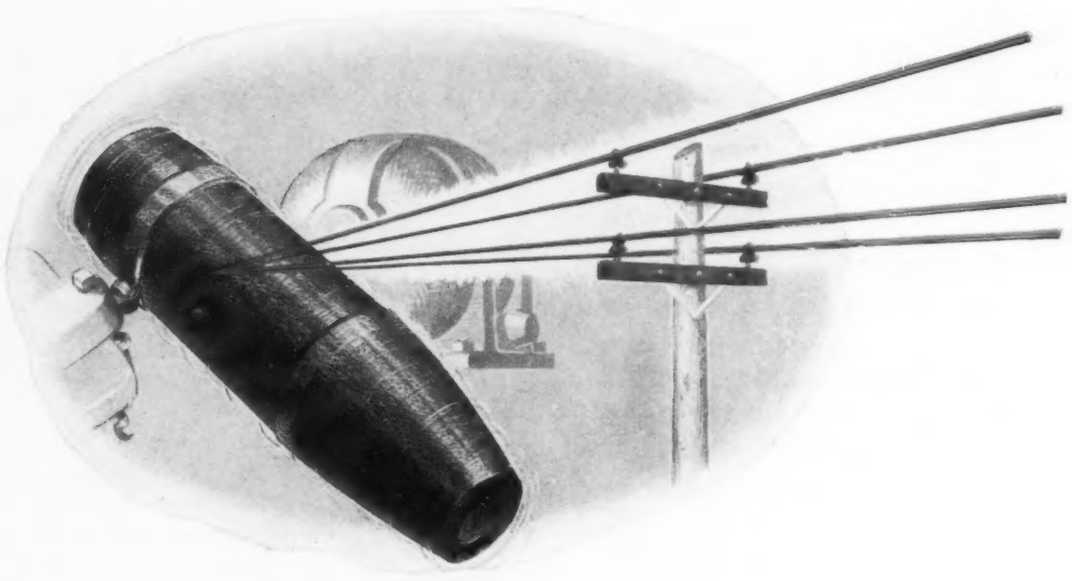
Power Power More Power



More Power FOR DEFENSE PRODUCTION —

MORE POWER CONDUCTORS TO FEED DEFENSE PLANTS

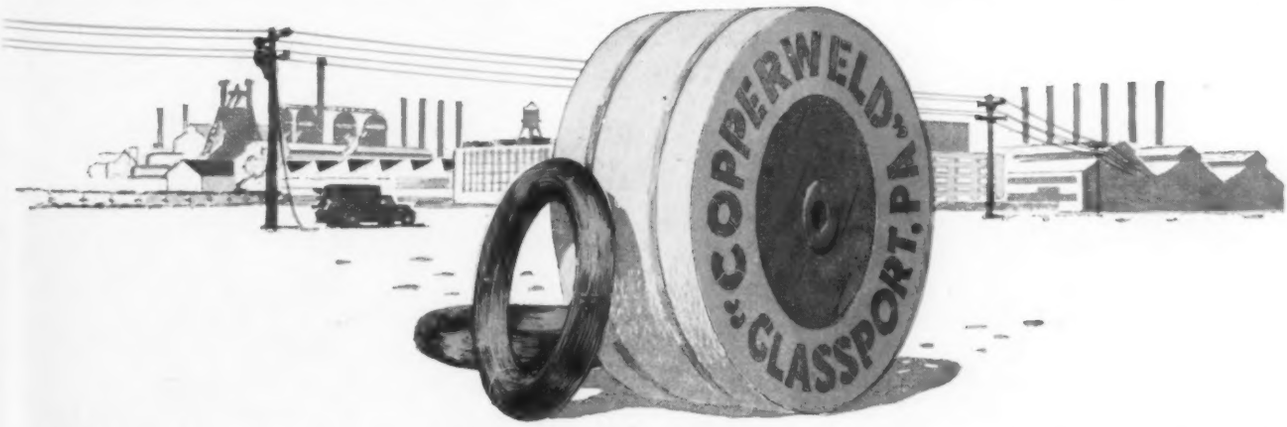
The sudden and unprecedented demands for more products—more guns—more tanks—more airplanes—a lot more of everything—are creating new loads with an inevitable demand for MORE POWER AND MORE POWER CONDUCTORS.

"Demand" is a mild word — it's really a *flood* of orders for Copperweld Conductors, an overwhelming deluge compared to normal demand. It's too sudden for any expansion to catch up with it immediately. Copperweld's present plant and workmen are busy night and day producing all the Copperweld products the plant can possibly turn out.

If your order is one of the many making up this deluge, can we hope that you will remember this one thought—you are not alone in your need of conductors. It's a problem of the entire electrical industry, and the entire industry must work together on it.

We won't burden you with our own difficulties of obtaining needed copper and steel, more machinery, more trained men—we have those problems too. But we can promise you that we are doing our best to produce all the Copperweld products that can be turned out of our mill, and we are adding plant capacity as quickly as we can obtain the necessary production equipment.

COPPERWELD STEEL CO., Glassport, Pa.



PACIFIC COAST REPRESENTATIVE: **C. E. INGALLS · Rialto Building · San Francisco, California**

THE Switch is ON... COOKING'S GOING ELECTRIC!

. . . THAT'S THE THEME OF THE BIGGEST MKB RANGE ADVERTISING CAMPAIGN IN HISTORY!

INDUSTRY ADVERTISING that heralds "The Switch is to Switches" now appears in five national magazines. It sells electric ranges ten months out of the year. More than 60,000,000 selling messages reach *your* customers during 1941. This is the . . .

BIGGEST INDUSTRY NATIONAL ADVERTISING CAMPAIGN in the history of electric ranges. It is sponsored by the manufacturers listed below, and it offers you an outstanding opportunity to make greater sales and greater profit *right now,* because . . .

"SWITCHOVER MONTH", the MKB Fall Range Promotion, brings the full impact of all this advertising right onto your own sales floor. It's a *complete* campaign — Plan Books, Window Displays, Direct Mail, Counter Cards, Newspaper Ads, transcribed one minute Radio Programs — all tied *together* and all tied-in with the theme of the national advertising!

NATIONAL ADVERTISING . . "THE SWITCH IS TO SWITCHES AGAIN"
. . . "SWITCHOVER MONTH"
ELECTRIC RANGES
Switchover MONTH
"THE SWITCH IS ON"

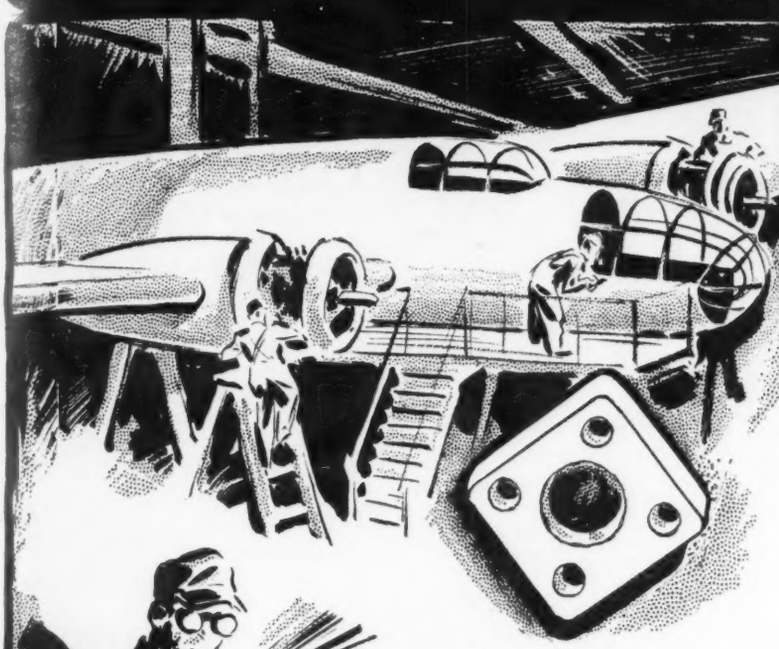
Geared together!

SWITCHOVER MONTH—the industry's newest promotion—and The Switch is to Switches—the industry's greatest national advertising theme—tie right in with each other like a pair of gears! Be sure that *you* tie in, too! It will mean that you CASH in. Ask your electric league, distributor, utility or any of the manufacturers listed below. Or write to:

THE MODERN KITCHEN BUREAU, 420 Lexington Avenue, New York, N. Y.

DUTCH-OVEN • ESTATE • FRIGIDAIRE • GENERAL ELECTRIC • GIBSON • HOTPOINT • KELVINATOR • MONARCH • NORGE • QUALITY • STEWART-WARNER • UNIVERSAL • WESTINGHOUSE

WOULD YOU BELIEVE IT?

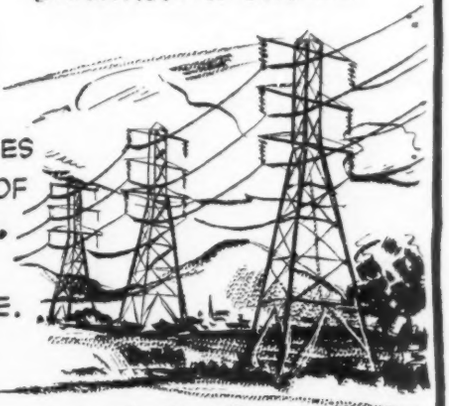


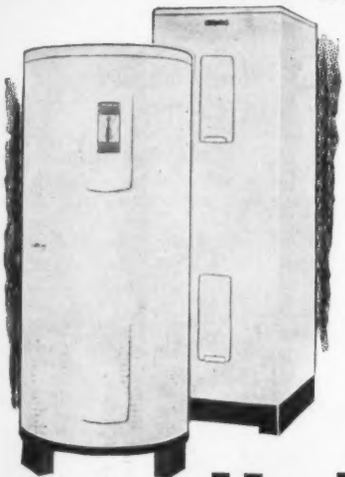
PRECISION TOOLING

IS VITAL TO AIRPLANE MOTOR CONSTRUCTION. **HOTPOINT ELECTRIC WATER HEATER** UNIT HEADS MADE OF THE FINEST SOLID BRASS ARE **PRECISION TOOLED** IN ONE PIECE TO INSURE YEARS OF SATISFACTORY SERVICE.

U.S. MINT SILVER

COMES FROM THE SAME MINES THAT PRODUCE THE SILVER USED FOR SOLDERING THE COPPER SHEATH TUBES INTO THE FORGED BRASS UNIT HEAD OF **HOTPOINT CALROD IMMERSION UNIT.** USE OF THE "SAFE-T-SEAL" MATERIAL SEALS COILS FROM AIR AND MOISTURE. ..GREATLY INCREASES THE LIFE OF THE CALROD UNIT!





OVER 7 MILLION HOMES

HAVE NO OTHER UTILITY SERVICE BUT ELECTRICITY AND THEREFORE CAN USE ONLY AN ELECTRIC WATER HEATER FOR COMPLETELY SAFE, ECONOMICAL, AUTOMATIC HOT WATER SERVICE. GET YOUR SHARE OF THIS GREAT MARKET!

ELECTRIC Water Heater sales are booming as never before. And Hotpoint is the one for you to sell because it offers these great advantages: **1.** It is the best known and most complete line in the industry. **2.** It is backed by a powerful trade paper advertising campaign reaching builders—men who account for 70% of water heater sales. **3.** Homeowners read the Hotpoint Electric Water Heater story in national magazines. **4.** Hotpoint gives you real sales promotion aids. Send the coupon NOW for full information. Edison General Electric Appliance Co., Inc., 5612 West Taylor St., Chicago, Illinois.

AUTOMATIC ELECTRIC Hotpoint WATER HEATERS

ELECTRIC RANGES • REFRIGERATORS • WASHERS AND IRONERS • CLOTHES DRYERS
AUTOMATIC DISHWASHERS • ELECTRASINK • STEEL KITCHEN CABINETS

Edison General Electric Appliance Co., Inc.
5612 West Taylor Street, Chicago, Illinois

Please send me full information on the complete line of Hotpoint Automatic Electric Water Heaters.

*Name*_____

*Address*_____

*City*_____ *State*_____

ELECTRA'S HUSBAND

A Neglected Education

ELECTRA was never one who could be accused of being bashful. Thus last month on our vacation trip up North when she happened to meet the big chief of one of our Western power companies she plied him with so many questions that I was almost tempted to flee in embarrassment. It was after dinner and we had been indulging in some reminiscing about a recent convention when Electra suddenly asked:

"What do you executives do with your time when you are not attending conventions?"

"My dear young lady, you'd be surprised," said the C.E., who fortunately possessed a sense of humor that was equal to the Irish brand of Electra herself. "In addition to being a well versed and practical engineer, an expert accountant, a keen analyst, an astute lawyer, a super-salesman, a financial wizard, a tax expert and a long range prophet, an executive today must be able to discuss intelligently and with conviction all of the current problems such as: When will we enter the war? How long will it last and what will be its outcome? Was Hess crazy or smart? What will President Roosevelt say or do next? Will the stock market go up or down and why? What horse is going to win the seventh race at Hollywood next Saturday?"

"But those things apply to the head of any kind of a business," Electra said, not in the least abashed. "They're a lot of generalities."

"You didn't give me time to get specific," the C.E. chided. "In addition to all of those things, he must see that his company is complying with the Holding Company Act, the Water Power Act, the Wage and Hour Law, all rules and regulations of the SEC, FPC, FCC and OPM, all other federal and state laws, city and county ordinances, franchise requirements and all of the 'rules of the road.' But that isn't all."

"It's pretty near enough," Electra countered. "I never knew there were that many laws affecting one kind of a business."

"Your education has been sadly neglected," the C.E. said with a twinkle in his eye. "However, aside from all of those pastimes, an executive has nothing to do but satisfy the demands of his stock and bondholders, meet the requirements of thousands of customers, keep peace in a family of hundreds of employees, see that good public relations are maintained by setting a good example himself and negotiate union agreements."

"Now you're stretching things just to impress my own dumbness on me," Electra told him with just the faintest tinge of a blush starting upward from her neckline.

"Oh, but I'm not through yet," the C.E. bantered. "This executive must see that his company renders A-1 service. Then he has to be a home-loving father, an upright citizen and an inspiration to his own children and the youth of his community. He should be a reasonably good after dinner speaker and ought to play a good enough game of poker, bridge and golf so that he won't lose his shirt and at the same time won't alienate his friends. Finally he has to go home at night to dream of the glories of public power competition, supervision, regulation and integration."

"But when does he go to conventions?" Electra asked, getting back to the subject that started the discussion.

"In his spare time," the C.E. answered innocently.

LATER during the trip we passed the site of a new army cantonment where machines and men were engaged in a frantic battle against time to get buildings up before trainees arrived. A line gang was setting poles not far from the site and as we approached I was sure that I recognized the bearing and stature of a squat and husky figure who was obviously the foreman. Surely enough it was Slats Murphy who had been running a gang down South one summer when I carried chain for a survey crew during a summer vacation. The out-of-state license on the car must have given me away because Slats recognized me as I climbed from the car.

"Did you ever learn to wear the spurs, son, like you said you would when we were down there in the desert?" was his greeting. "Because if you did I can use you right now."

Without waiting for an answer he launched forth with a typical Murphy story.

"It's this way," he said. "Just last week I called the division super and told him that if we were to get this ring-tailed, black cat of a line in by the time these army guys wanted it, we'd need some more linemen. He said you couldn't get 'em for love nor money but he'd see what might be done. Every crew on the system is busier than bird dogs.

"Two mornings later Jimmy drove out from the warehouse in the trouble car with two boomers in the seat beside him. I didn't have to look at their cowboy boots to know they were from Texas. But they had tools. Well, I asked the biggest one what they could do.

" 'We're the best —— —— layers-uppers, tyers-inners and getters-atters that wears spurs,' he said. 'We've worked for every outfit from here to Beaumont and there ain't nothin' we can't do.'

"We were setting some higher sticks back down the road so as to be able to put the 33,000 on top of the 2,300. And we were leaving the 2,300 hot. So I told the biggest one to go up and start cutting the stuff loose from one of the poles. He did all right. He just put on his spurs and belt and went up that pole like a squirrel. With no gloves, no blankets, no snakes, he started working on that stuff.

"If I hadn't been able to holler I might have fainted. 'What in the beards of the seven prophets do you think you're doing?' I yelled.

" 'Ain't this the way you do it,' he said innocent as a child. 'This is the way we always work this stuff.'

" 'Get down off that pole and get going quick,' I shouted. He did and they both left. I don't care where they went, but if they work that way up here very long they'll be cooked ganders. So that's why I say if you can climb, I'll give you a pair of spurs and send you up right now."

ELECTRA has been wondering what is going to happen to prices when some of the new alphabetical agencies back in Washington get through with them. A friend who has just returned from there epitomizes the Washington philosophy this way: When farm prices go up, that is justice; when wages go up, that is social progress; but when finished goods prices go up, either at the manufacture level or at the retail level, that is either profiteering or conspiracy.

From Warehouse to Pole

NO RATTLE BREAK or ROLL

• Thomas "Pakt-To-Stack" cartons save space in your storeroom, may be stacked easily and safely. Each is legibly marked for quick identification and safely sealed against contamination.

THOMAS INSULATORS

Here's a strong new carton designed especially for Thomas 6" and 7½" diameter strain insulators. This carton is now our standard package for all units except hook-stud. Users have found there's real economy in buying their porcelain insulator requirements this "Pakt-To-Stack" way. The carton itself is light in weight, but rigid, strong and durable, guaranteeing safer and speedier handling with no breakage — all of which means lower construction costs when you specify "Thomas".

No. 1204
10,000 lb. M. & E. Rating
6" "Standard" Design

No. 1277
10,000 lb. M. & E. Rating
6" "Heavy Disc" Design

• Thomas "Pakt-To-Stack" cartons assure quicker delivery to construction crews by simplifying handling. Linemen like the lighter weight carton, find it withstands extremely rough handling and speeds construction.

Packed—6 per Carton
Gross Wt.—39 lbs.

• The Thomas "Pakt-To-Stack" carton is made of strong fibreboard and is especially designed for maximum durability and protection to the insulator. Each insulator unit fits snugly into a separate and heavy fibreboard compartment. Double sides to the carton afford more than ample protection assuring safe delivery.

Thomas Porcelain Insulators packed this modern way cost you no more than others.

THE R. THOMAS & SONS COMPANY

ENGINEERS MANUFACTURERS DESIGNERS

LISBON, OHIO, U.S.A.

OUR 68TH YEAR

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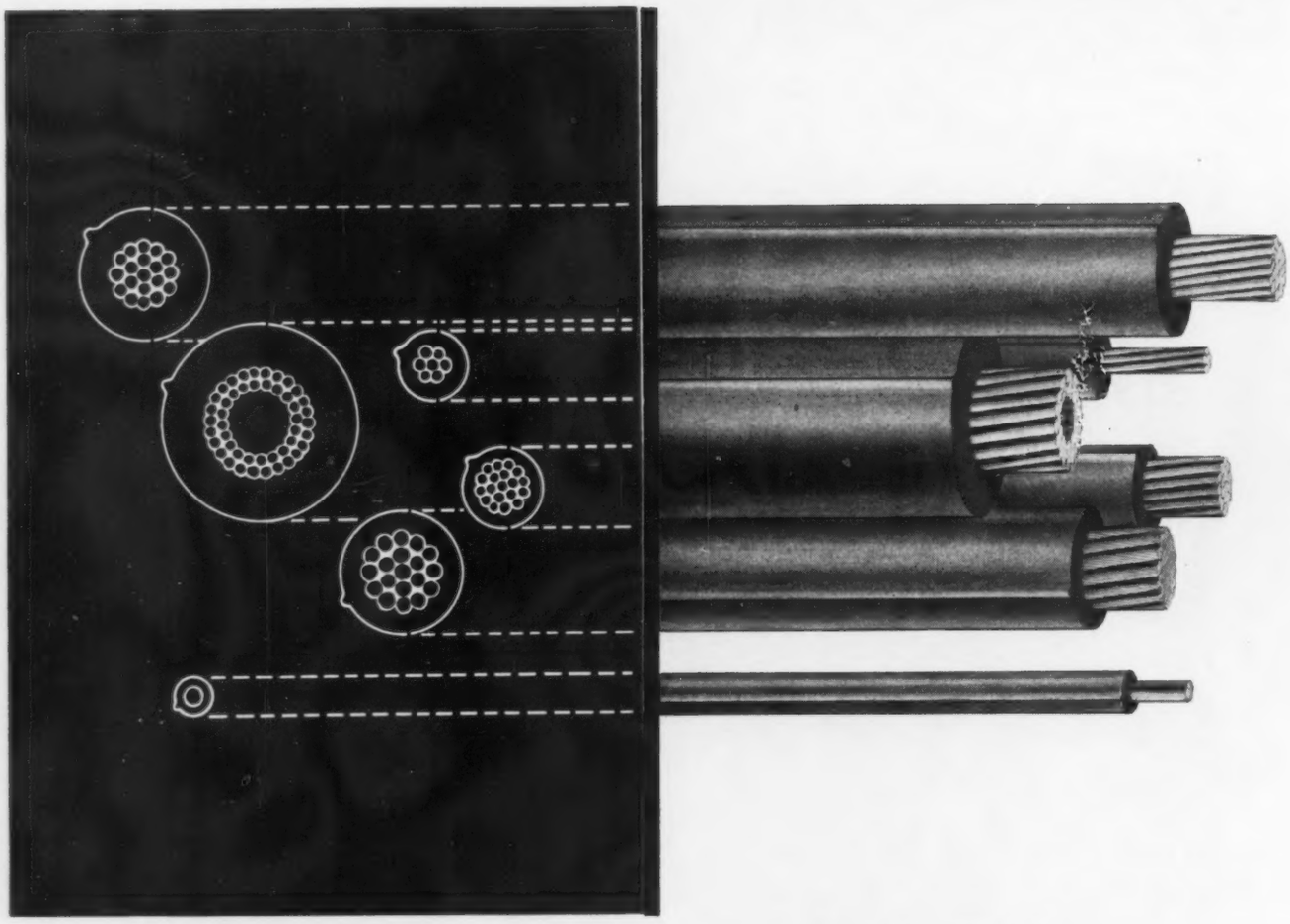


PERFECTLY CENTERED CONDUCTORS

Any section of Okonite insulation, anywhere through the entire length of any Okonite wire or cable, will show conductors perfectly centered in a wall of dense, tough insulation, compounded only from Wild, Up-river fine Para rubber.

This perfect centering, a direct result of the Okonite strip-insulating process, assures a uniform wall thickness of long-lived Okonite insulation all the way around the conductor to provide full electrical protection throughout its entire length.

Great mechanical strength, long service life and insulation resistance far in excess of accepted standards are other Okonite qualities which have distinguished this dependable rubber insulation for more than 60 years.

THE OKONITE CO., PASSAIC, N. J.
Offices in principal cities

5 FOUNDATIONS OF OKONITE QUALITY

1. Made only with Up-river fine Para rubber carefully washed and dried
2. The Okonite formula is proved by long use rather than accelerated tests
3. Conductors perfectly centered by the Okonite strip-insulating process
4. Uniformly vulcanized under pressure in a continuous metal mold
5. Thoroughly tested and inspected throughout the manufacturing process

Okonite's Okoloy coating on conductors eliminates corrosion

OKONITE

OKONITE

INSULATED WIRES AND CABLES

ELECTRICAL WEST

VOL. 87 NO. 2
AUGUST, 1941

LIGHTING OUR SKYWAYS

Airports and seadromes throughout the Nation now have standardized and improved lighting and radio facilities

By Fred J. Wellhouse

Aviation Lighting Engineer
Westinghouse Electric & Manufacturing Co.
San Francisco

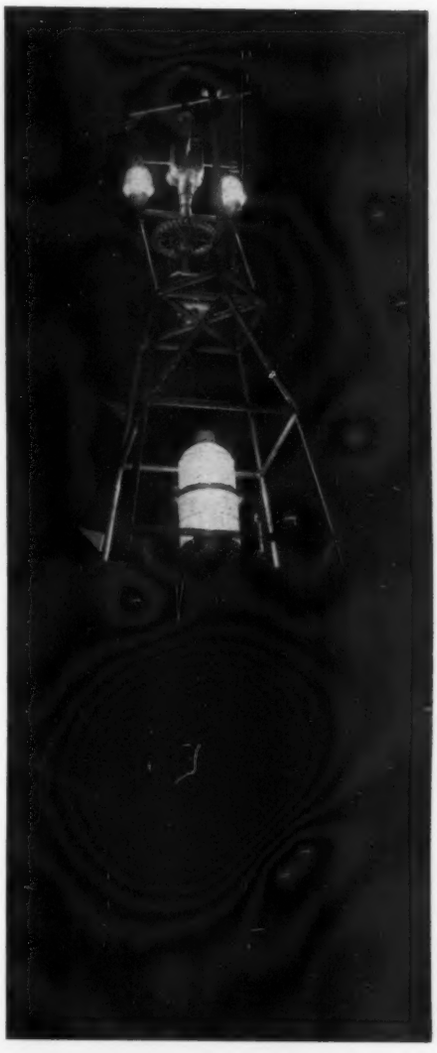
AIRPLANES by the thousands — landplanes and seaplanes, training planes, pursuit and interceptor ships, observation and photographic planes, bombers, troop and supply carriers — are rolling from the nation's doubled and redoubled aircraft factories.

Airports and seadromes by the hundreds are being rushed to completion to receive them. Both commercial and military aircraft today must operate on a 24-hour "around the clock" basis. Many of our existing air routes are being extended, and many new ones are being laid out.

Today this intensive activity is spurred by military necessity, with the government pouring millions into the program. Tomorrow, without doubt, these newly created facilities for aircraft manufacture and air travel will prove a tremendous spur to peacetime travel and shipment of goods by air, and will help to bring the cost of air travel and shipment down within reach of virtually everyone.

Progress in all phases of aviation has been rapid in the past few years. The lighting of skyways and ports has kept pace. Lighting along the air lanes has been standardized for some time by the Civil Aeronautics Administration. Now lighting facilities at the ports are being standardized and improved so that no matter at which port the pilot lands, the lighting conditions will be safe— and the same.

Night travelers along the skyways in commercial ships or private planes often remark about the well defined line of lights that marks the route as effectively as today's express highways are marked for motorists. Flashing beacons designate the "highways of the sky." Here and there air travelers come to switching points where lighted tracks branch to the left or right, leading to



Auxiliary beacon, above, flashes in green the code letters designating the airport. Red obstruction lights are mounted on the tower supporting the weather recording instruments above it

★

Instead of a floodlighted runway, which sometimes gives a deceptive idea of the distance to the ground or permits glare from floodlights to hit the eyes of pilots, contact lights bordering the selected runway permit landing in the dark with greater accuracy. The plane's own wing headlights aid in determining the ground level for contact and landing

different cities in the far off distance.

Electricity and two of its "children" —light and radio—are teamed to guide today's airplane safely to its destination at night. The night air traveler sees flashes of red, white and green in the darkness; landing lights; the maze of lights about the ports.

Flashes of white light along the route are produced by rotating beacons so timed as to flash every 10 sec. Lenses on opposite sides of each beacon send out a narrow beam of light of 1,800,000 cp., in a direction slightly above the horizontal. When close by, the observer notes that this beam sweeps around the circle, but from his seat in a plane at a distance, he sees only the flash as the beacon points briefly in his direction.

Ordinarily, these beacons are spaced 10 mi. apart. From the air on a clear night, the traveler can see perhaps five or 10 of them stretching ahead, covering a distance of 50 to 100 mi. In such beacons, as in all of the lights which help to guide or warn the flier, two sets of lamps are provided so that if one burns out, there will be no chance of an unlighted beacon. The lighted lamp is in the focal position. If this lamp burns out, an automatic lamp-changer moves it out of the focal point and brings the spare lamp into focal position. Periodic maintenance is provided by the CAA.

Spacing Closer in Rough Country

In rough or mountainous country, the beacons are spaced closer together and are supplemented by stationary auxiliary beacons mounted on a platform above each rotating beacon. The auxiliaries consist of a combination of two Fresnel lenses which throw a narrow horizontal fan of light all around. These give a steady light visible at all times but from a shorter range than the rotating beacon, so that the pilot may judge his position with respect to more hazardous terrain.

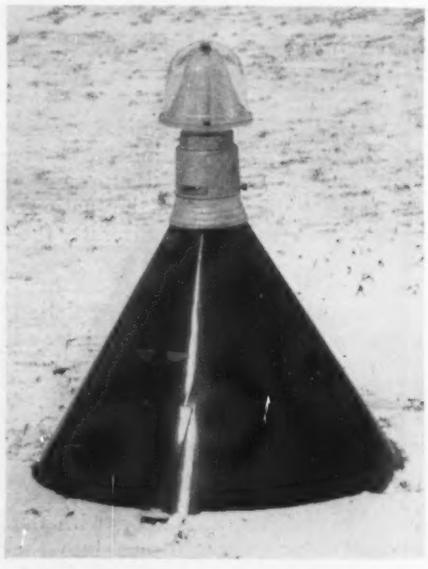
Occasionally the night traveler sees flashing red lights. If he times the flashes, he finds they occur 40 times a minute. These are obstruction lights, provided on all high obstructions such as radio towers, transmission line poles and towers, smokestacks and so on, as a safety warning.

As the plane approaches large cities, the traveler sees what seems to be a confusion of lights twinkling or gleaming in all directions. But the pilot is not confused. He can still find his way unerringly along the course or to a landing. It is unlawful to have a rotating or flashing light without special permission of the Department of Commerce. Hence even with the thousands of street lights and lighted windows, the pilot can follow the flashing beacons through the towns and cities on the well defined routes.

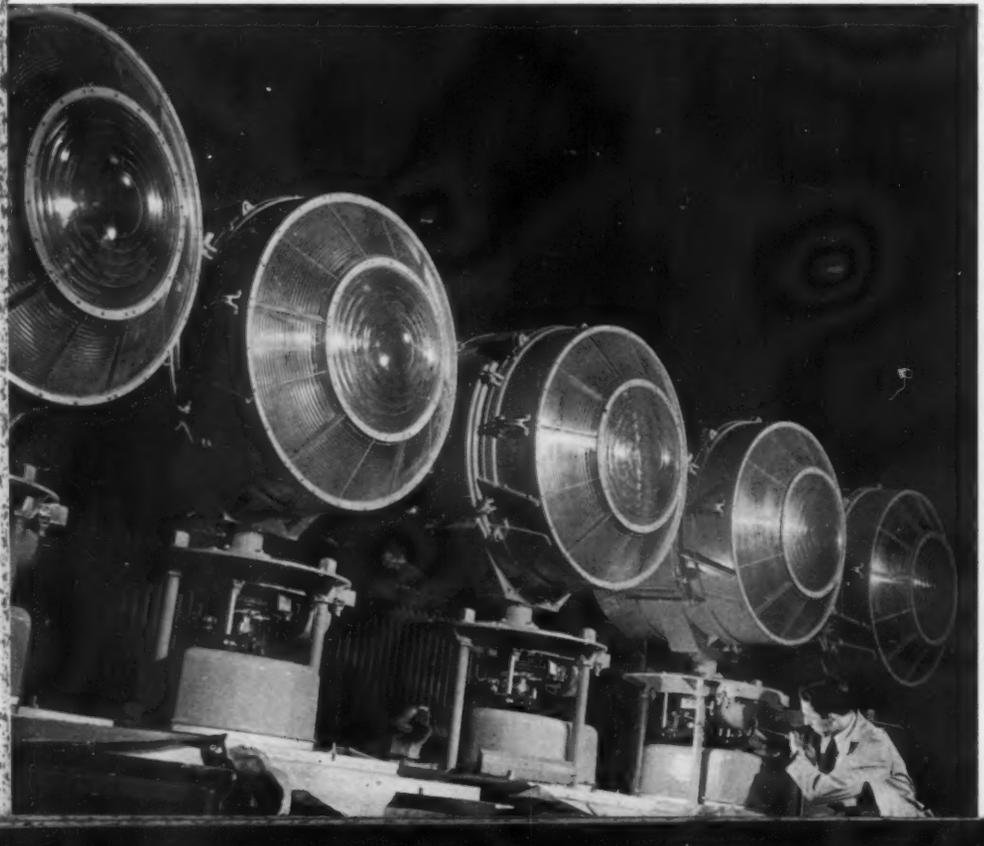
Usually near the larger towns and cities but also at intervals along the entire route, the traveler will see a beacon that flashes alternately green and white, designating an airport at which landings can be made. Above the rotating airport beacon is mounted a green auxiliary Fresnel type beacon that flashes Morse code letters to designate the name of the port. As the plane begins to descend, the observer notes a large black area which is defined by white lights and is adjacent to the green-and-white flashing auxiliary beacon.

The white lights are known as boundary lights, and are spaced every 300 feet around the port, marking its size and shape. Each boundary light is provided with a prismatic lens that directs a very wide beam upward so that it may be seen from the air in virtually any direction.

Somewhere out in the light-bordered area, far away from the buildings, will be seen a large lighted cross which is usually outlined with thirty 25-watt lamps. This cross is the "wind tee," and is carefully balanced on a pivot so as to indicate the true wind direction. The pilot, if desired, may check it against a lighted wind cone or "sock" which is usually mounted near the control tower. Here and there in the line of lights bordering the port, are a few green lights. These are "range lights" that designate the beginning and end of landing runways.



Boundary lights, like that above, are spaced about 300 ft. apart, have lenses that direct a wide beam of white light upward in all directions



Assembling a group of 36-in. double-end rotating beacons, equipped with 1,000-watt, automatic lamp changing, lamp equipment. They throw a 1,800,000 cp beam, visible for 20 miles at night

Communication by Radio and Light

At intervals or whenever desired during his flight, the pilot may communicate with the control tower operator at the next port of call or at any other port within range of his radio apparatus. And the tower operator again calls upon light to enable him to determine the "ceiling"—the distance from low hanging clouds or fog, to the ground. He uses what is known as a "ceiling

projector." This is a narrow beam searchlight located on the edge of the airport and 300 ft. or more from the control tower. Its beam is projected directly upward so as to produce a spot of light on the overhanging cloud or fog. By means of a "clinometer," the operator points its sights at the spot of light on the "ceiling," then reads the height on a scale.

Harbors, lakes and rivers can be turned into seadromes by stringing floating buoys equipped with radio controlled, battery operated fluorescent lamps, such as at extreme right. Next to it, a typical rotating beacon installation. Below, the pistol grip portable "traffic signal" gadget with which to signal to planes. Lower picture shows a contact light in the ground, dismantled. The Fresnel lens is being inserted; cover lens and metal cap are removed. Unit is embedded in concrete along the runway

The control tower operator also may communicate with private planes flying about the port, even though those planes may not be equipped for radio communication. Here, again, he makes use of light in a device called the "portable signal gun." This is a small drum, about stovepipe size, having sights by which it may be pointed accurately toward an approaching plane. It throws a very narrow beam of intense light which can be seen by a pilot in clear weather about five miles away in the daytime, and perhaps 10 mi. away at night. On the lower side of the drum are two pistol grips. One controls color screens—reds, green and white—and the other controls the flashes of light for signaling purposes. With this device, the operator can communicate with the pilot by means of codes, telling him to delay landing or to land, as the case may be.

When it has been decided which runway is to be used by an incoming plane, the control tower operator turns on the landing light facilities for the runway selected.

For many years, various types of landing lights have been in use. Most of them have been floodlights, throwing a low horizontal fan of light with a cutoff a few feet above the ground, and lighting either the entire landing area or the runway to be used. The many arrangements of airport runways have required varying arrangements of floodlights, with the result that there have been many different lighting systems on different airports, sometimes to the confusion of pilots.

Trend Toward Standardization Now

The trend now is toward standardized landing light facilities that will be the same at all airports, so that no matter which port the pilot enters, he can always correctly determine the location of the ground when making his contact.

A contact lighting system developed during the past few years consists of a series of low mounted lighting units projecting only two inches above the ground and spaced 200 ft. apart along the edges of each runway. The light is controlled by means of refractors on the side edge of the unit so as to produce a maximum beam up to and down the runway, at a slight elevation above the horizontal. The top of the unit is of metal, strong enough for the plane to run over without damage.

When the pilot is at a considerable height above the ground, these units appear to be far apart. As he approaches the runway, the perspective seems to draw them closer together, and when the plane is on the ground, they appear to be almost a continuous line of light. This change of perspective gives the pilot a means of judging his closeness the the ground; and with his own headlights, which are usually mounted on the leading edges of the wings, he can make contact, always under the same conditions.

Contact lights of this type are white on the approaching side until the pilot comes to within 1,500 ft. of the far end of the runway. Then the lights appear yellow, warning him that if he cannot stop within the remaining 1,500 ft., he must take off and try landing again. Contact lights for the first 1,500 ft. on each end of the runway have a split color screen showing yellow on the side toward the middle of the field and white on the side toward the edge of the field, so that the pilot will get the yellow warning no matter which direction he lands on the runway.

Planes which have just landed on smaller ports, use the runway to taxi back to the passenger terminal. On the larger ports, there are separate taxi strips so that the runways will not be unnecessarily congested. Along the sides of these taxi strips are blue lights similar to the contact lights. These blue lights guide pilots across the dark field to the passenger station.

The contact lighting system provides ease and safety of landing without the use of floodlights. Except for the area directly in front of the landing plane—an area illuminated by the plane's own headlights—the airport is dark. The edges of the runway on which the plane is landing are marked only by the small amount of light from the contact lights.

Low Visibility System Coming Into Use

During the night when the weather is clear, passengers can observe the lights which guide them safely to their destination and the ground. But when the visibility is low and lights cannot be seen, the pilot gets his directions by instruments and radio, and keeps on course by radio beam. On the major airways, radio beams are broadcast

from airport to airport. Signals thus sent out are translated to visual indications, by instruments, as to whether the pilot is to the left or right of his route, or "on course."

At present, it is necessary for planes to land only at those ports where visibility is adequate, except where instrument landing facilities have been installed. Some airports already have been equipped with low visibility landing systems, and more such installations are going in or contemplated. Briefly, low visibility landing systems consist of a combination of radio beams that guide the pilot close enough to the beginning of the runway and the ground to enable him to see the runway lights.

The plane is guided to the airport by the "course radio beam." About a mile from the port, a "secondary course beam" is picked up. The pilot follows this secondary beam, and soon picks up a "parabolic radio beam" which is tangent to the ground on the runway, and rises gradually to a point about 800 ft. above ground, outside the port. The pilot follows this parabolic beam downward and along the approach to the runway until he comes within sight of a series of cross-bar neon tubes, each tube about six feet long and spaced about 100 ft. apart, which indicate that he is approaching the ground and the beginning of the runway.

He passes over some "lead-in lights" which throw their beams vertically, and knows that almost immediately thereafter he can see the contact lights and complete his "thick weather landing." The contact lights are arranged so that three intensities of brightness can be obtained. Under ordinary conditions, the low intensity is used. The brightest is used only in cases of extremely low visibility. When these low visibility landing systems are installed at the principal airports, it will be possible to land at the regular airports at night in virtually any sort of weather.

Light for the Seadromes New

The use of seaplanes is growing. These range from small single-engine ships equipped with pontoons instead of wheels, to the big Clipper ships which span the oceans. Lakes, inlets, rivers and bays may be their "landing fields." Requiring no expensive grading, leveling and paving, these water landing areas are being used in ever increasing numbers for daylight flying activities. Because of the lack of lighting facilities, however, it has not been possible to use them at night until very recently.

During the past few years there has been an intensive study of seadrome lighting equipment to fill this need. Experimenters have tried various types of buoys, using power supplied by cable from nearby land. It was found, however, that the constantly moving buoys sooner or later caused crystallization of the cable connections, and they would break. Metal buoys were hazardous to landing seaplanes because the ships often would be blown into the buoys with resulting damage to wings, pontoons or hull.

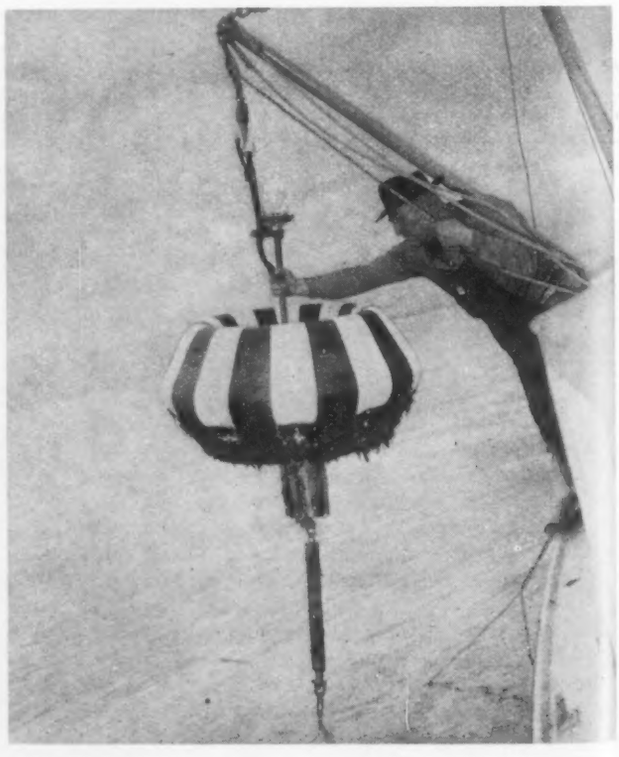
A new type of lighted buoys was developed recently through the cooperative efforts of the Firestone Tire and Rubber Co. and the Westinghouse Electric & Manufacturing Co. This consists of a large doughnut-shaped rubber buoy in which is mounted a self-contained battery-operated light. These seadrome contact lights proved so successful that the first lighted seadrome in America was installed last fall in San Francisco bay between Treasure Island and the Oakland shore. By federal law, this area was set apart for the exclusive use of seaplanes. The boundary is marked by this same type of buoy with flashing lights, as a warning to all surface craft to keep out of the restricted area. Within this area, rows of seadrome contact lights are installed to help the seaplanes to descend and make contact with the water in a manner similar to that used by the land planes at the airports.

In the seadrome contact light, a small coiled tube fluorescent lamp about the size of a hen's egg is surrounded by a prismatic lens. The lamp consumes an extremely small current. It is operated from dry batteries through an inverter which changes the direct current from the battery to alternating current. A transformer steps up the voltage to that necessary for the lamp. This light will operate for approximately 300 hr. on one set of batteries.

When use of the seadrome is infrequent as at present, the contact lights are turned off and on by hand, at each buoy. Where more frequent use is desired, however, a radio-controlled buoy-borne light is recommended. A transmitter on land nearby, or on a control barge, is capable of sending out radio impulses of different frequencies. Each buoy is equipped with a small radio receiver with whip-like antenna similar to that used on automobiles. Various lights can be turned on as desired, according to the tuning of the particular receiver sets and the frequencies used at the transmitter.

By their designed shape, the buoys compensate for the action of waves, resulting in a steady light even though a considerable sea may be running. Pressure is equalized between the interior of the buoy and the outside atmosphere, so that it is very soft and can be struck by a seaplane's hull or pontoon without damage. Tests have shown that on being hit, the buoys simply bob beneath the water and come up again with their lights shining. They are fastened in position by means of anchor and chain.

It is highly probable that the National Defense program will bring in its wake further improvements.



Keeping the seadrome "doughnuts" anchored in place proved a problem in San Francisco bay. Although the barnacles and teredos were unable to puncture the rubber doughnut, electrolysis decomposed the bronze eye on the battery basket and the iron chain. A bar of industrial Micarta separates these two metals now and saves the chain. Neither teredos nor barnacles affect it either. Note how white rubber discourages the barnacles at the white stripes. Latest doughnuts will have all-white bottoms

A modern 2,000,-kva. unit sub-station with switchgear for high voltage incoming loop feed installed for an Arizona power company is typical of latest distribution practice here in the far West

DEVELOPMENTS IN DISTRIBUTION SYSTEMS

Economy, efficiency and flexibility are characteristics demanded for modern distribution facilities. New equipment is available for the engineer to provide these essential advantages to an increasing degree

By A. W. Copley
Pacific Coast Engineering Manager
Westinghouse Electric and Manufacturing Co.

IN THIS period of high industrial activity brought about by the immense national defense program when the electric utilities are being called upon for ever-increasing amounts of power, the extension and expansion of power systems is imperative. In carrying out such extensions the power companies must watch closely the effectiveness of every dollar spent for plant investment. A realization that the distribution system involves probably more cost per kilowatt of load than does the generation or the transmission systems to which so much analytical study has been given, is therefore focusing attention on this part of the system at the present time.

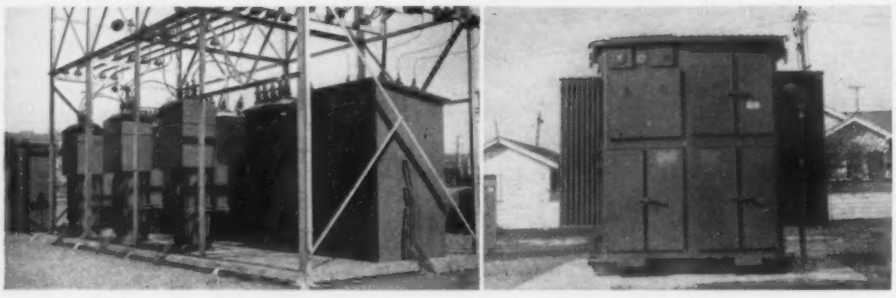
Intensive study of transmission systems has brought about changes in the characteristics of generating units, the use of synchronous condensers at main substations, high speed relaying, and other features aimed at obtaining stability and giving continuity of service. Distribution systems, however, have grown up and been extended in many cases with less consistent planning.

As a result of economic pressure, more engineering thought has recently been put upon distribution. It is probable that if economics were left out of the picture, we could physically connect enough lines and big enough lines with enough transformer and breaker capacity to give good electric service to most customers by means of the old radial system of distribution without the modern development of means for power factor correction, automatic reclosing of breakers, or networks. However, a survey of a system built in that way would show that there would be an excess of transformer capacity and that more or larger lines were being used than would be desirable if considered from the standpoint of the load carrying ability of the units involved.

During the past 20 years the distribution system has been progressively improved by: (1) The secondary network; (2) power factor correction; (3) self-protecting distribution transformers; (4) automatic reclosing of breakers; (5) self-protecting power transformers and unit substations; (6) banking of transformers; and (7) light-duty networks for overhead systems. No attempt has been made to present these in chronological order nor will all of them be discussed. Viewing the electric power system as a whole, the beginning of the distribution system may be considered as the substation stepping down from transmission to distribution voltage. The conventional substation has consisted of one or more incoming lines with circuit breakers and lightning arresters, high voltage bus, transformers, together with their high voltage and low voltage circuit breakers, the low voltage bus and circuit breakers and voltage regulators for the various feeders. This combination was all constructed by labor at the location using the various units as they came from the manufacturer.

Modern Substations

Today the substation has been very greatly simplified. It is constructed as a unit by the manufacturer and has only to be set on a platform and connected to the incoming and outgoing lines. Because of the ease of installation and the small space occupied, it can be considered as a less permanent fixture than the old substation. If because of shifting loads another location might become more desirable, it can be easily transferred. This allows the distribution system to become more flexible and substations can be made to follow the load. Such a substation may consist of a single unit, which comprises the transformer with automatic tap-changer, fusible links in the high-voltage leads to clear the unit in case of internal trouble, lightning arresters and a low-voltage circuit breaker which will clear any low-voltage short circuit without causing the fusible links in the high-voltage leads to fuse. Automatic reclosing equipment can also be used with the low-voltage circuit breaker. The connections are simple, involving



Contrast in distribution substations is vividly illustrated by these two Western installations. At the left is a conventional 1,875-kva. station of the vintage of 1929. At the right is a modern 1940 version of a 2,000-kva. station complete

only three incoming leads and three outgoing leads. The simplicity and ease of installation of such a unit can be illustrated by more than one case in which a 1,500 to 2,500-kva. transformer was installed on what was a vacant piece of property, connected to the circuit and put into service in less than 24 hours.

The idea has been extended to take care of several feeders by what is called the unit substation, in which an enclosed switching structure is mechanically connected to the transformer, the whole being fabricated and assembled in the manufacturer's plant. In this case there will be the three high-voltage incoming leads to the transformer and as many feeder circuits as are provided for by circuit breaker positions.

To the feeders which run from the substations, distribution transformers are connected at intervals so that the secondary runs to the loads may be as short as possible. With the old radial system each distribution transformer was a unit, independent of other units except for the fact that it was connected to the same primary feeder. A short circuit or an overload on a customer's premises might blow the fuses at the transformer and all customers connected to that transformer would be deprived of power until the fuses could be replaced. Of greater moment in the case of a feeder fault, all service supplied by transformers connected to that feeder was suspended until the fault could be cleared. When continuity of service was of the utmost importance to a consumer, the circuit supplying him was often arranged with duplicate feeders with a throw-over switch so that in case a primary feeder was put out of commission by a ground or short circuit, the service could be continued by throwing the transformer over to the duplicate feeder. Naturally, under such an arrangement the feeder circuits could not have a good load factor.

The Secondary Network

The importance of the continuity of service to congested load areas in cities brought the first big development in distribution systems. This was the

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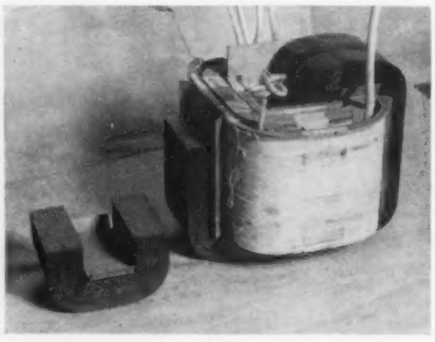
Below is a partially assembled Type C distribution transformer core employing hypersil, a new magnetic core material



secondary network, a solidly inter-connected system of low voltage leads fed from many transformer banks which, in turn, were connected to several feeders. A load anywhere on this network would be supplied from all transformers and all feeders, most of the power of course coming from the transformers nearest to the individual load. The result of this was a more uniform loading of transformers and very much better regulation than could possibly be obtained by the radial system. In case of a fault there was enough capacity connected to the network to cause it to burn clear.

The development of the network was only made possible by the solution of the problem presented when a feeder became short-circuited. An answer to this problem was found in the network protector. This piece of apparatus is located at each transformer bank and is a means for disconnecting the bank from the network in case of a fault on the feeder supplying that bank, thus preventing the "feeding back" of power from the network itself into the feeder fault. The network protector as developed also provided for automatically reconnecting the transformer to the network as soon as the fault on the feeder was removed and voltage was restored to it.

Industrial Networks

To incorporate a network in an existing system does not necessitate a complete changeover. "Spot" networks may be installed in the particular localities in which the system is warranted. Networks for industrial plants, for instance, are becoming quite common and some of the munitions plants are finding in the system the solution of many problems. For most industrial plants the a-c secondary network is almost the ideal type of distribution system. In addition to providing service reliability, it gives flexibility, which permits adapting the system to growing or changing load conditions at a minimum cost and with a minimum interference with the normal plant operation. It provides also good voltage regulation, which permits the use of across-the-line starting of relatively large motors. Altogether it gives the highest quality of service with a minimum of operating and maintenance expense.

The industrial network is modified somewhat from the usual form of secondary network now widely used for distribution in the business districts of cities. It is generally unnecessary or impractical to have more than two primary feeders for supplying industrial plants, and with half the transformer capacity connected to each primary feeder, there would have to be an excessive amount of transformer capacity used in order to take care of the condition existing when one feeder is out of service on account of fault. This is obviated by the use of a double throw primary switch at each network transformer and by arranging the primary feeders so that any transformer can be connected to either of the two feeders. Normally, half of the network transformer capacity is connected to each feeder. When however, a fault occurs on one of the primary feeders, the faulty feeder is automatically disconnected from the system without any interruption of service by the tripping of the circuit breaker at its supply end and by the tripping of all network protectors in the secondary leads of the associated network transformers. This, of course, leaves the entire system load being supplied by the one primary feeder and through half of the network transformers. But in the usual industrial plant, it requires only a short time to complete the switching

operation of throwing the transformers all over to one feeder. To take care of the temporary condition, it is only necessary that the transformers have a short time overload capacity sufficient to take care of the double load for the time required to make the changeover.

Networks used for the industrial plant are generally in the form of a loop rather than the mesh which is used for urban networks. As faults on the secondary loop may not be cleared by burning off, arrangements are made to clear those faults without interruption of service by means of limiters located in each end of the secondary cable. This is a specially designed, completely enclosed, heavy copper fuse or weak link, used only to give protection against short circuits. A diagram of a system such as has been described for an industrial plant is shown in one of the accompanying illustrations.

Banking Distribution Transformers

At the recent Coronado convention of the Pacific Coast Electrical Association there was some discussion of the banking of single-phase transformers in lightly loaded business districts where a network could not possibly be justified. This so-called "banking" simply consists of tying together the secondaries of adjacent transformers so that load may be served with better regulation and with more uniform transformer loading. With this system if the ties between transformers are solidly made, a fault on a part of the system will communicate itself from one transformer to the other by cascading action, and in order to prevent such action it has been the usual practice to use fuses in the inter-connecting circuit. A recent development points the way to the elimination of these fuses by the use of self-protecting distribution transformers provided with two low voltage circuit breakers inside the tank. One of these breakers will be connected to the local load of the transformer and the other connects to the tie to the next transformer with its load. A transformer so arranged will be known as a "banking transformer" and its development will undoubtedly bring about a wider use of the "banking" idea.

The arrangement is really the outgrowth of the completely self-protected distribution transformers developed a few years ago, in which there is incorporated not only the low-voltage circuit breaker but fusible links and surge discharge gaps in the high voltage side and protective gaps on the secondary terminals. The circuit breaker on the low-voltage side is arranged to give a warning if the transformer is being overloaded, this warning consisting of a light which is turned on under such conditions. If the overload becomes dangerous or is an actual short circuit or fault, the circuit breaker opens entirely. On the Pacific Coast where lightning is not as much of a factor as in some other parts of the country it is not unusual for the surge gaps to be omitted but the other valuable features of the transformer are retained.

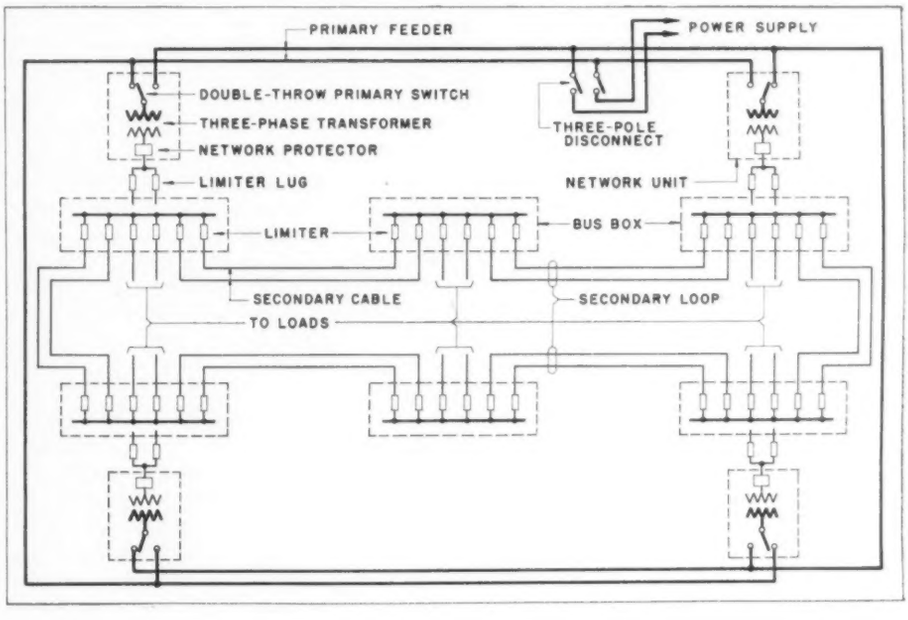
This type of transformer has tended to bring out the loading of transformers by temperature which of course gives the maximum use of the transformer capacity. It has been recognized for some time that on a very large number of circuits transformer capacity was determined not by the load-carrying capacity of the transformer but rather by the regulation which would be allowed on the secondary circuit. Good regulation is often obtained by using a larger size transformer with lower ohmic reactance. Therefore, full advantage cannot always be taken of the development just mentioned in reducing transformer capacity.

In order to obtain the most economical transformer loading, it is not only desirable that the units be able to carry short time overloads but that the regulation be as good as possible.

A radically new transformer design brings great help to the operating company on the two factors which have just been mentioned, namely, short time-rating and regulation. For many years it has been recognized that the permeability of steel is greater along the grain than across it. The difference is not great in ordinary silicon steel as used in transformers for the past 30 years, but it actually exists. However, the designer could not make use of this difference in permeability until a method was found of building a core in which the flux could be made to always follow the grain of the steel. When such a method was developed it became feasible for research engineers by a study of this characteristic of steel to develop it to a point which allows a very material reduction in magnetizing force for a given magnetic flux when the flux follows the grain. Conversely, by keeping the magnetizing force the same, the amount of flux could be materially increased. Steel of this new type develops a third more flux for a given magnetizing current than was possible with older type material. As a result of this development the transformer can be made smaller, requiring less iron and consequently less copper. Because of the small size, the heat path for radiation is reduced and the transformer can have a higher short time-rating. Also, as the coils and iron are smaller for a given rating, the reactance can be made lower, which results in better regulation. This development therefore gives a tool to the transformer design engineer so that he can vary the characteristics of the transformer over a considerable range and magnify those features which are most important for any particular size.

Transformers with these characteristics are now available and their use together with the other modern developments for the distribution system as discussed here, will make for more reliable, more satisfactory, and more enonomical service.

For industrial plants the a-c secondary network such as that sketched below provides service reliability, flexibility and good regulation with a minimum of operating and maintenance expense. It is finding wide application in defense installations



UNDERGROUND FACILITIES IN SMALL COMMUNITIES

1-Santa Rosa Technique Is New

By W. P. Bedgood
Pacific Gas and Electric Co.

SIMPLICITY, flexibility from trouble or special help and speed with which repairs can be made are advantages that characterize the underground system which serves the business district of Santa Rosa. This community is a typical rural town of 12,500 people, located some 54 miles north of San Francisco. The underground system serves the business district, an area of 10 blocks, approximately 0.3 miles wide and 0.6 miles long. The buildings in this area vary from one to six stories and average two stories. In general, stores occupy the ground floors and offices occupy the floors above street level. No industrial consumers are in this district. The principal load served is lighting, power being only 20% of the total. Practically all of the lighting is single phase, three wire. The transformer capacity serving the underground system is 1,185 kva.

The system was installed in 1939 and 1940. In each case an ordinance passed by the city council ordered the company to remove its overhead lines from certain designated streets, also ordered property owners to provide service entrances for the new system.

Nineteen manholes of three sizes house the 4-kv. equipment. Manholes 7 ft.x7 ft.x7ft. are used where transformers are not to be installed. These contain primary disconnects and in some cases cutouts. Manholes 7 ft.x10 ft.x7 ft. contain transformers of medium capacity, complete with primary cutouts, disconnects, secondary fuses and multi-taps. Manholes 8 ft.x12 ft.x7 ft. are located where it is believed transformers of 200 kva. or larger will be installed at a future time. Twenty-two hand-holes are used of two sizes for secondary and service equipment. The larger size 30 in.x42 in. contains fuse splices and multi-taps. The smaller box, 18 in.x30 in., contains multi-taps only. The boxes have a minimum depth of 18 in.

Four-inch soapstone duct is installed for the primary conductors. Some 3,100 duct ft. are installed, 150 ft. being six-way and 2,950 ft. four-way. Three-inch wrought iron pipe is used for primary taps feeding transformer manholes on streets where it will not be necessary to install main lines in the future. Secondary conductors are run in 3 and 3½-in. pipe. Services are in 2 and 3-in. galvanized conduit. All ducts and pipes are in the sidewalk area, except at street crossings. With one exception, all manholes are in the sidewalk area, as are all hand-holes.

Soapstone duct was chosen for two reasons: (1) Ease of pulling in non-leaded cables and (2) it was found to be the most economical for the job. The ducts are encased in a concrete envelope, spaced 1 in. apart, with 3-in. concrete walls, floor and top. Only one duct is used at this time. In a few years it will be necessary to underground all of the 4-kv. feeders from First Street Substation so duct space was provided.

Manholes, ducts and pipes were placed in the sidewalk area for economy and convenience. Costs of breaking and putting back pavement are much less for sidewalk areas than street areas. The public is less prone to criticize for tearing up sidewalks than when a newly paved street is torn open. Construction and maintenance can be carried on more conveniently in the sidewalk area, as traffic is not a consideration. Hazards from traffic are reduced to a minimum. Last, but not least, automobiles cannot be parked over manhole covers in the sidewalk area. This can be very embarrasing when a transformer fuse blows, a block is in darkness and the troubleman finds a locked automobile parked over the manhole cover.

Manholes are located in accordance with the future needs of the system. Nine manholes are at intersections so that the system may be expanded when necessary. Transformer manholes are located close to major loads to cut the length of heavy secondary runs. In two instances, manholes are located on easements on private property. Manholes are spaced about 200 ft. apart. This spacing should be sufficient for future growth in a rural town. All primary, secondary and service cables are rubber insulated, non-leaded type, with the exception of two former primary

Sidewalk hand-holes offer the advantages of freedom from traffic hazards and easy availability for maintenance without trouble from parked automobiles

risers, which are now taps, and one secondary run, all of which were in existence prior to the underground installation.

Rubber-insulated, non-leaded cables are used because it would not be necessary to employ special help to install and maintain the system. The job was designed so that splices would not be necessary. Primary cables terminate in primary disconnects, cutouts and transformer terminals. Secondary cables terminate in multi-taps and fuse splices.

All primary conductors are rated at 5 kv. The main line conductors are three 250,000 circ. mil twisted cables. The transformer taps are three No. 4 twisted cables and the primary neutral is No. 1/0 bare copper cable. Secondary cables are rated at 600 volts. Main runs consist of two 250,000 circ. mil cables for "hot legs", one 1/0 cable for "power leg" and 1/0 bare copper cable for the neutral. Primary and secondary neutrals are connected at each manhole.

Service conductors are identical to the secondary conductors. Services originate at multi-taps or fuse splices and terminate at the customer's meter. Where 2-in. conduit is used, a Type "C" condulet is placed in the conduit run at the property line, about 1 ft. above sidewalk grade. Where 3-in. conduit is used, the condulet is omitted. In all cases the company owns the facilities to the condulet, or coupling, 1 ft. above the sidewalk, the customer owns from that point on. The average service consists of 1/0 cables for "hot legs" and No. 4 cable for the "power leg" and/or neutral. Larger customers are served with 250,000 circ. mil cables and a few small customers with No. 4 cable.

The underground system is served by three pole risers. Each riser may be served by a different overhead circuit, or it is possible to serve all from one overhead circuit. For simplicity in operation, the underground system is separated into three sections, each served by a riser. Should a fault develop, one third of the system only would be interrupted. The faulty section can be readily isolated and service re-established. Dead-blade disconnecting switches are installed on the pole end of each riser.

Seven sets of oil break disconnects are in service. Special terminals are provided for rubber insulated non-leaded cable. The system can be sectionalized so that any transformer bank may be fed from either of two sources. All taps, risers, transformer feeds and main line sections are controlled by oil break disconnects.

Two types of transformer cutouts are used. One is the conventional oil fuse type; the other, a dry type cutout using an enclosed fuse with an arc condenser, forming a horizontal blade of a two-break switch. Conventional man-hole type transformers are used having special terminals for rubber insulated non-leaded cable.

Multi-taps are used for all secondary connections from transformer delta bus to the service connection. Secondary fuse splices are used on divided secondaries, (two or more runs from the main circuit), also on large services. Fuse sizes range from 150 to 600 amp.

Because part of the system has been in operation about a year and a half, and the balance six months, operating experience is limited. The following observations, however, are pertinent.

All types of equipment have been submerged for a period of several days with no bad results. To date all equipment has performed in a satisfactory manner.

As previously stated, the load is 80% lighting and 20% power. As most of the consumers on the former overhead system received single-phase services, there was no reason why a change should be made. This meant the installation of a large lighting transformer and small power transformer in each bank, connected open "Y" primary and open delta secondary. The transformer banks consist of a 100-kva. lighting transformer and a 25 or 37½-kva. power transformer. The transformer primaries are staggered on the 4-kv. circuits so that the circuits are balanced under normal operation. Any transfer of load from one 4-kv. circuit to another tends to create an unbalanced condition. Another disadvantage with this connection is that adjacent transformer banks are usually on different primary phases, so secondaries cannot be paralleled. When it is necessary to take a bank of transformers out of service, two short service interruptions are necessary, one in transferring the load to another bank, the second to put the load back on the original bank.

It is the writer's opinion that the Santa Rosa system, with its rubber-insulated non-leaded cables, oil-break disconnects, dry type primary cutuots with multi-taps and fuse splices in secondaries should give longer, trouble-free service than the conventional, or so-called standard type of underground system for the following reasons: (1) Its extreme simplicity; (2) its flexibility; (3) no potheads with attendant trouble are required; (4) no special help is necessary; and (5) if a fault should develop, repairs can be made in less time than on the so-called standard type of system.

Economics of Small Town Distribution

By PAUL SURANSKY
Pacific Gas and Electric Co.

PUBLIC utilities are paying increasing attention to the problem of lowering the cost of distribution. With a large capital investment per dollar of gross receipts, it becomes important that those in the industry should exert every effort to keep this investment at an economic minimum. At the same time the investment should be utilized to the fullest extent in order that charges may be kept low.

However, first cost or capital investment is not the only factor to be considered. Frequently savings in other costs such as depreciation, maintenance and operating expense, may more than offset additional investment costs and hence justify a greater initial capital outlay.

Hence, whenever it becomes necessary to replace existing overhead distribution with underground facilities, engineers should give due thought to the selection of the type, materials and equipment, design and installaiton of the system, as well as service requirements, operating costs and future load growth. Thus when either the pressure of public relations or the inadequacy of overhead facilities bring decisions to go to underground, consideration should be given to the newest techniques. The three articles on the subject "Underground Distribution in Small Communities" were designed for the purpose of stimulating thought along these lines.

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EDITOR'S NOTE: These articles constitute a PCEA symposium and were the feature of the Coronado Engineering and Operating Section sessions.

II-Characteristics of Different Cables

By E. L. Brentnall

The Okonite Co.

OF NECESSITY cables used for underground distribution in small towns fall into two general categories: (1) metallic-covered, meaning lead, and (2) non-metallic. Considering first lead covered cables, the dielectric most frequently used is impregnated paper, chiefly because it is suitable for practically all voltages and because it is reasonable in price. Some varnished cambric has been used and considerable rubber likewise has been used under the lead, the latter particularly for secondaries.

The object in placing a lead sheath over the dielectric is to prevent moisture, acids and alkalis from reaching the dielectric and causing failure as those particular dielectrics were never intended to be proof against moisture, acids or alkalis. Following this line of reasoning a lead covered cable may be said to be only as good as its sheath and that should the efficacy of the sheath be destroyed either because of mechanical damage, imperfections in manufacture or chemical reactions, the efficacy of the cable itself is destroyed.

Utilities and manufacturers alike have long recognized this problem and have therefore bent their efforts toward improvement of lead sheaths by overcoming flow lines and charge flows, oxidation and impurities, using alloys where necessary. It can safely be said that the lead sheaths of today are of much improved quality over the sheaths of a decade ago.

Non-metallic cables are confined pretty well to rubber compounds and synthetics. Because of the nature of rubber it is necessary to make a subdivision and differentiate between primaries and secondaries.

For primaries it is necessary to take into consideration and provide for corona. Some small town primaries operate at 11 kv. In such cases it is necessary to provide an electrostatic shield properly grounded. At 5 kv. by the use of "neoprene" or "koroseal" synthetic jacket, shielding is not necessary. In all cases utmost care must be exercised in the correct choice of dielectric. Oxygen is one of the greatest deteriorants to a rubber compound and a perfect bonding between the dielectric and the synthetic, thus eliminating the oxygen, makes the combination of a good dielectric and the synthetics ideal from the standpoint of longevity. It is essential to eliminate corona and hence ozone in manholes because even if the primaries have been designed to withstand it there have been cases known where the ozone generated by the primaries attacked and caused failure of the secondaries in the same manholes.

Primaries with synthetics are much to be preferred to the fibrous covered or braided types. As for the secondaries, voltage being nominal, the characteristics which should be sought are a 75 deg. C. temperature compound, ability to resist normal acid and alkali solutions and residual grease or oil in ducts, together with high mechanical strength —in the order of 3,600-lb. per sq. in.

With every engineering problem there goes hand in hand the ever present economic problem. What is logical for one small town to do is not necessarily feasible for another. For example, trained lead cable splicers may reside and be available in one locality where in others those specialists might have to be imported.

Before weighing any relative merits of one type versus another two points must be acknowledged (1) That all engineering problems when solved are, in effect, compromises. You have to sacrifice in a minor degree some desirable thing or characteristic in order to obtain something else slightly more desirable at the moment. (2) Most important, no one dielectric or type of cable possesses *all* of the known desirable qualities and characteristics. For example:

a. A lead sheath is ideal for excluding moisture or oils from the dielectric.

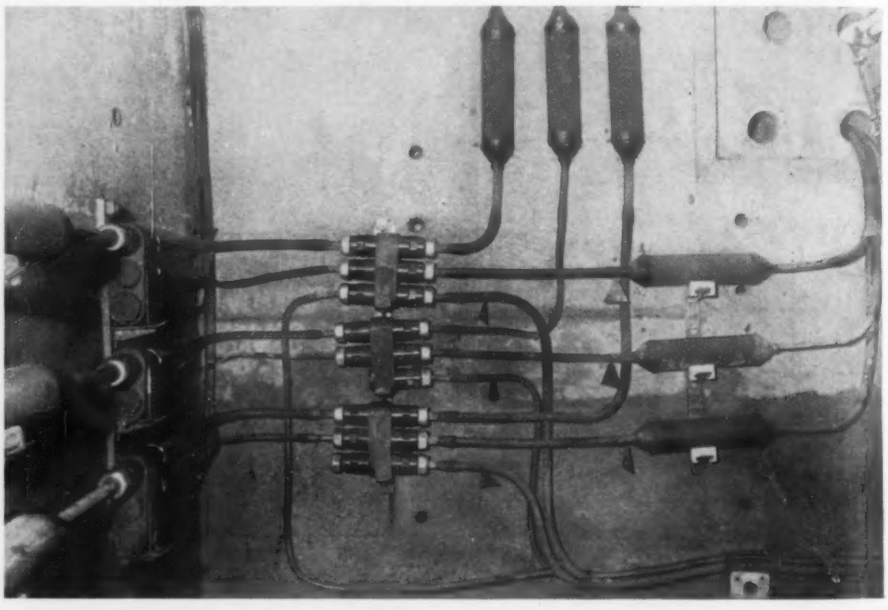
b. A 60% jacket is good for moisture, not good in the presence of oil, yet is non-inductive and unaffected by electrolysis.

c. At 11 kv. a compound must have high dielectric strength and ability to resist corona but high mechanical strength must be foregone.

d. For 600-volts sufficient electrical strength and a high degree of mechanical strength and ability to age well are desirable.

The whole question being, therefore, one of compromise all of the known operating conditions must be set up on one side of the ledger and on the other side the exact prescription must be written which will fit those particular conditions—taking into consideration what is available.

An honest inventory of the advan-



Multi-taps and secondary fuse splices are used on divided secondaries with fuse sizes ranging 150 to 600 amp. for Santa Rosa simplified underground installations

tages and disadvantages, the opportunities and limitations of the various types reveals the following:

Leaded Cables

Advantages: (1) Under normal conditions it is granted that a lead sheath offers the finest and most permanent protection to a cable. (2) High temperature operation is permissible.

Disadvantages: (1) Cannot be used where electrolysis is present either chemically or in the form of stray currents. (2) It is highly susceptible to failure under vibratory conditions. (3) It requires potheading at all voltages and wiped sleeve joints. (4) Inductive and sheath losses are prevalent in some cases. (5) Cannot be used on high pole risers due to hydrostatic head and migration of oil.

Non-Metallic Cables

Advantages: (1) Easier to handle and install being lighter in weight; utmost simplicity. (2) Not as susceptible to mechanical damage as lead. (3) Does not require wiped joints or potheading at 5 kv. or under, thereby reducing installed costs. (4) Where Ph. content of residual water is high, this cable will be unaffected.

Disadvantages: (1) Rubber should not be used in the presence of oils nor subjected to direct rays of sun although synthetics overcome this objection. (2) Operating temperature limited to 75 deg. C. copper up to 8 kv. 70 deg. C. above, although this in turn is compensated by better thermal characteristics and no sheath losses. (3) The chief disadvantage of non-metallic cables generally is the fact that there is no minimum standard of quality or design, with the result that in the search for economy there have been cases of improper designs being used.

In this brief space it is impossible to point to any moral or give a specific recommendation general enough in character to cover *all* cases. In conclusion, one observation or admonition to be made is that no distribution engineer in his search for reduced costs should jeopardize the permanency and reliability of a system by any compromise with inherent quality of materials used.

III-Economics of New Equipment

By Henry H. Buell

Pacific Gas and Electric Co.

IT IS generally agreed that underground construction is expensive at least in comparison with equivalent capacity overhead construction, and many distribution engineers have always felt that little can be done about it. Viewed as a whole this may appear to be true, but when it is considered that the whole is made up of a number of component parts, and that even small reductions in cost in these various parts may amount to a great deal in the aggregate, it is well to analyze the various items from this point of view. In all lines of endeavor new and better ways of doing work are being developed and underground construction is not excepted.

All new equipment must be considered from at least three angles: cost, safety, and ability to function under the prevailing conditions. Unfortunately, the operation of underground equipment introduces certain inherent hazards which must be accepted. Allowances must be made in design, frequently at the expense of cost, especially under present conditions when more and more thought is being given to the prevention of accidents. These inherent hazards include the handling of large blocks of power in confined quarters with small space factors and the close proximity of low resistance grounds.

The most difficult handicap to overcome, not only in the design of underground equipment, but also in the reduction in the hazards involved, is this space factor. Space is always limited in underground construction and equipment must, therefore, be made as small as possible consistent with proper carrying capacity, clearances and ease of operation.

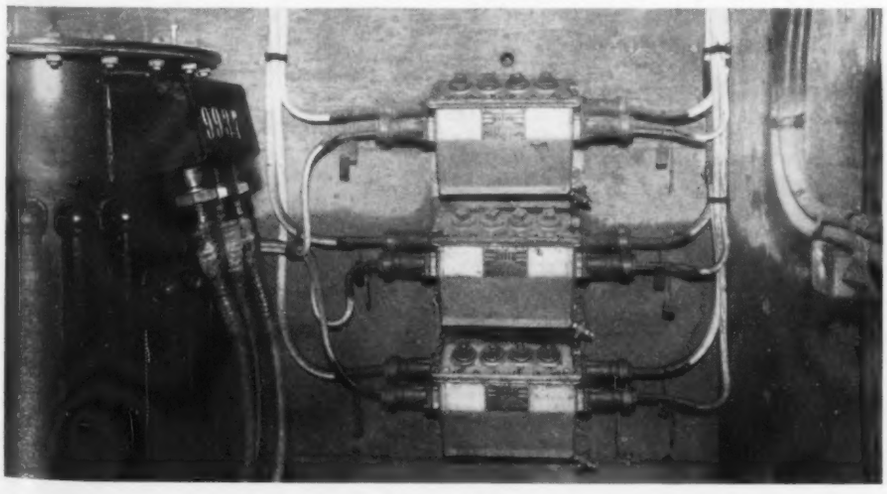
This discussion is intended to present the various types of equipment now available on which experience has been had. In the consideration of the following items thought must be given to the above mentioned three fundamental details of design.

Underground Primary Switching Equipment

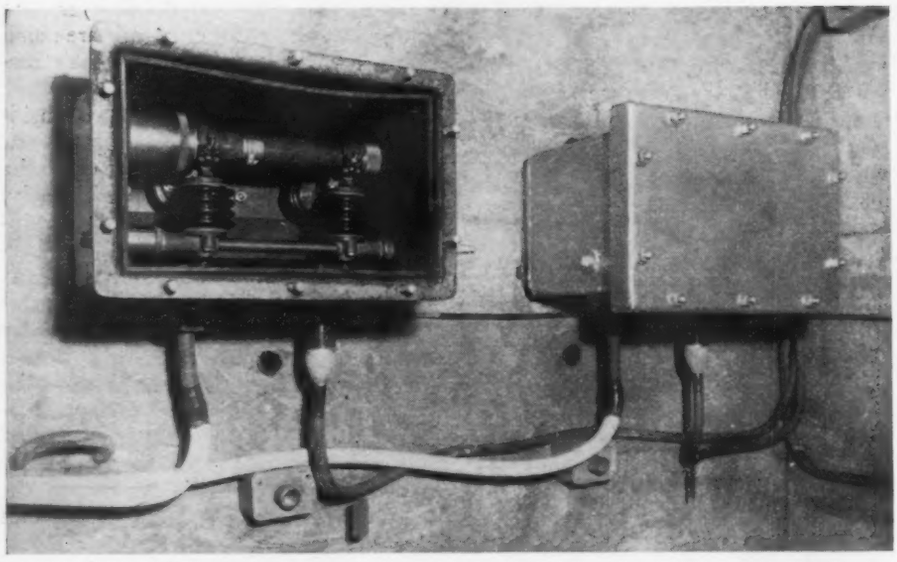
There are three general types of equipment now in use for switching or sectionalizing underground primary circuits: (1) The ordinary dry-type junction boxes with all three phases in one case. (2) Oil-break junction boxes with each phase in a separate case. (3) Oil switches or circuit breakers of the ordinary type equipped for underground installation. Each type has certain desirable and undesirable features, especially when viewed by the smaller operator.

The dry-type of three-phase junction box requires no particular description as it is well known to all engineers. Because of the fact that all phases on all branches are otherwise exposed when the cover is removed, it is customary to cover, by means of a removable adjustable insulating barrier, all of the branch feeds not being operated. Generally the individual phases are separarated by porcelain or plastic barriers, but, if the load being switched is of

Conventional manhole type transformers have special terminals for rubber cable; both oil fuse and dry type cutouts, as well as oil break disconnects are employed



UNDERGROUND FACILITIES IN SMALL COMMUNITIES



The dry type cutouts used in the Santa Rosa installation have an enclosed fuse with an arc condenser forming a horizontal blade of a two-break switch as pictured

any considerable amount, or if a parallel is broken, the ordinary small-town operator must exercise considerable agility in handling the link to sidestep what is to him a real hazard brought about by the resulting arc. Under modern operating methods, grounding of isolated sections of cable or equipment is necessary. This type of junction box does not lend itself readily to protective grounding, not only because the clearances are small but because there is no equipment now available on the market for grounding inside such boxes.

The oil-break type of junction box, at least in this part of the country, is comparatively new and there is little experience in its operation. One available type, single phase, requiring one box for each phase and arranged for four-way only at present, consists of a cast iron oil-filled box arranged for carrying the four-way leads in through wiped joints or compression gasket joints, depending on the type of cable. It is provided with four openings in the top, normally closed by screw-gasketted plugs. Through these openings, bayonet-type connectors or plugs are inserted by insulated handles, tying the four leads to a common bus in the lower part of the box, all makes and breaks being beneath the oil. This fact, together with the isolation of the phases, largely eliminates the arcing hazard considered inherent in the dry-type box. By means of short plugs which are guided by bushings in the openings in top of the box and which are connected to ground by the box or preferably by a flexible cable, it is possible to ground one or more of the branch circuits safely and bring about compliance with safety rules. So far this box is limited to four branches, which prevents its application in some cases.

The ordinary type of sectionalizing switch designed for underground construction has also been used for this purpose, but generally in special locations only, primarily because of the space occupied, the cost, and because the point of separation is not visible and grounding is impractical. The use of separate disconnect switches would add still further to these objections. The oil switch, however, has very definite uses.

Underground Primary Fusing Equipment

The types of primary fusing equipment now available and in use may be grouped into two major classes—the oil-filled type and the dry-type. Of the former two varieties are essentially properly designed fuses in a suitable holder immersed in oil and installed in a rugged case, with provision for venting the liberated gases, while a third is actually a circuit breaker in a suitable gasketted oil-filled box with means for exterior operation. The dry types so far encountered employ special fuses contained, in one case, in a diving bell type of box, the bell being removable, and in the second case in a gasketted metal box without oil. All types provide for carrying the two leads through suitable nipples to contacts within the container.

Fuse cutouts must meet certain definite requirements in underground construction the same as in overhead construction. As a fuse they must interrupt the current of the circuit under short-circuit conditions without failure. The container must be able to handle the tremendous energy generated under short-circuit conditions when the fuse functions. The fuse container must also be able to act as a switch and handle full load current without objectionable arcing. These requirements are much more difficult to meet underground because, in general, short-circuit currents are greater than on overhead distribution lines, and the personal hazard introduced by the possible failure of the equipment to handle the energy of a short circuit is greater. Several of the types of fuse cutout equipment under consideration employ special devices for limiting the short-circuit current and in other designs the fuse holder handles the current.

The standard oil-filled type of fuse cutouts are most familiar as they have been longest in use. In general, the latest design of one make at least will meet the most severe burden imposed on them in the field. The energy handled requires abnormally strong containers. Internal clearances must be great enough to prevent arcing between contacts or to the case at the time the fuse blows or when functioning as a disconnect. In this type of fuse cutout the contacts are not visible and the small clearances make it difficult to design a suitable grounding connection. This cutout in its latest design, however, has functioned satisfactorily for many years.

There are two schools of thought in connection with these devices. Some engineers believe that no fuse equipment can operate satisfactorily unless immersed in oil, while others are of the opinion that it is possible to design such equipment so as not to require oil and at the same time provide greater clearances and visual operation.

Secondary Connection Equipment

Under this broad heading may be grouped the customary secondary junction box which is merely a fused switching center for secondary mains and services, and the semi-solidly connected type of secondary switching center such as the "mole" and "multi-tap."

When non-leaded cables began to be used extensively, it was very apparent that some other type of junction box or connection equipment than that previously used was essential—one which would be simpler, cheaper, and sufficiently waterproof for the purpose. Accordingly, the "mole" and the "multi-tap" were developed and placed on the market. These devices are fundamentally the same, merely differing in some of the details. They consist essentially of a copper bus entirely insulated with rubber or rubber compound except where tapped for cable connections. Cable connections are made to this bus by means of a clamping device which makes a secure and adequate connec-

tion. These devices are arranged to connect any type of cable, such as lead-covered and non-leaded, paper, rubber, or varnished cambric insulation. They are made in a wide variety of carrying capacities and of arrangement of connections and will fill practically any requirement met in the field.

In general, properly installed and maintained, underground equipment operates year in and year out with little trouble, especially the secondary portion of the plant. Services are rarely disconnected and reconnected and their failure is very infrequent. Accordingly the "mole" and "multi-tap" have proven largely satisfactory. It is understood, however, that even these devices do not meet all the required conditions in some instances and that the junction box is still in demand by many operators.

Still a third type of secondary connection equipment has been long used in certain types of construction and is gaining favor in underground installations. It is a fact that the very large majority of manholes are never flooded and that if they are flooded, the water has a sufficiently high resistance so as not to cause a short circuit on secondary voltages, especially if the spacings are sufficient. Accordingly, secondary installations have been made which place the open secondary buses on the ceiling or upper part of the side walls of a manhole, permitting lugs attached to the ends of services and secondary mains to be bolted directly to the buses, thus eliminating entirely all special more or less expensive devices.

The question of whether or not to fuse secondary services and mains seems to depend on the conditions applying. Where a secondary network is involved, naturally no fuses are installed, in general. The satisfactory clearing of short circuits, however, on such systems depends on adequate capacity, generally supplied by large transformers of low impedance and with relatively large multiple primary feeds.

The small towns are rarely thus fortunately situated. While secondary runs must be of sufficient size to provide reasonable regulation, a short circuit on a large service or on the mains frequently would not burn off but would merely cook the insulation, ruin a lot of cable and ultimately burn up the transformer. Accordingly, a certain amount of fuse protection is the practice in most such small localities, not only to protect the cables and transformers, but also to act as switching equipment.

This fuse protection is supplied either by means of the usual type of junction box with fuses on the bus connections or by special waterproof fuses which are available for installation in the connections to "moles" or "multi-taps," where rather precise fusing is required or by "limitors" which provide short circuit protection. These devices are provided with rubber or composition covers for water proofing.

Experience has not provided a uniform practice regarding the use of fuses. In the smaller towns reliability of service is just as important as in large cities and if short circuits will burn up the transformers or blow transformer primary fuses and interrupt service to a considerable number of customers, fusing of services seems to be a reasonable economical practice. Similarly, for switching purposes, fusing of the mains is frequently indicated.

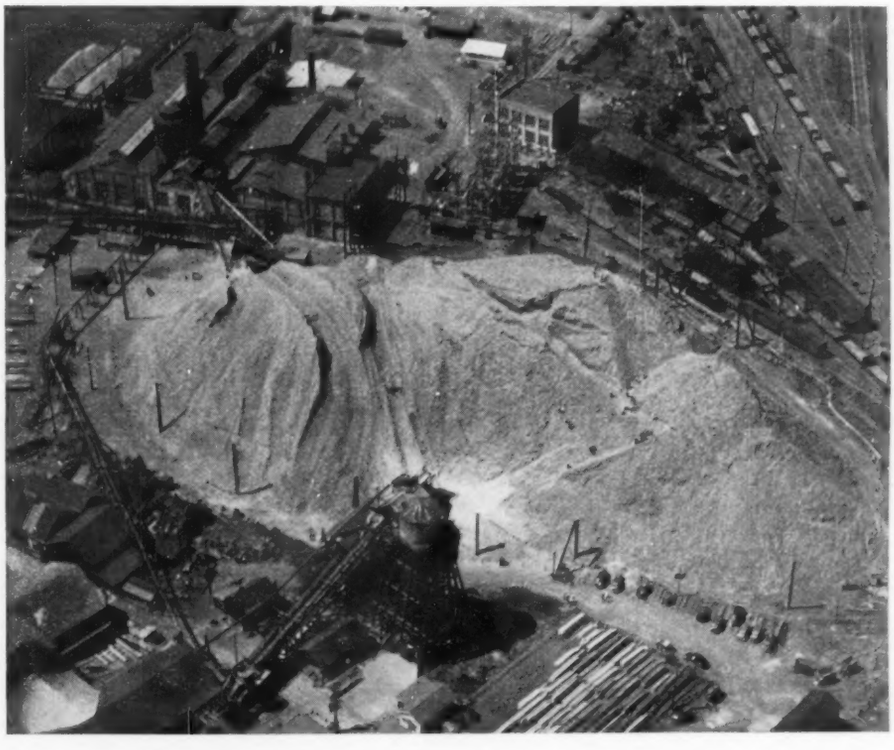
Leaded and Non-Leaded Connections

While the methods of connecting lead-covered cable to the nipples of various types of underground equipment, such as transformers, cutouts, and junction boxes, has become fairly well standardized as a result of experience gained over a period of many years, the use of non-leaded cables more recently introduced has required the development of a new technique in cable splicing. This technique at the present time, however, is fairly simple and justifies no more than passing attention. It is true that aging of the connections as now made may in the future indicate the need for more consideration and the use of different types of material than now employed because of inter-actions not now evident.

Fundamentally, the connection of non-leaded cable to underground equipment is carried out in the same manner as is done in connecting two lengths of rubber-covered cable. First, however, the equipment connection is generally brought out as a solid stud, made water tight by means of gaskets or packing rings and a union sleeve at the equipment. The two halves of the connection are then brought together, a sleeve sweated on, and the joint properly taped and painted.

In some cases the insulation on the outside connection is made water tight to the equipment by the use of a seal ring which is clamped on the insulation by a packing nut. This serves the same purpose as the tape covering, providing a mechanical packing joint which is probably superior to the tape joint, is properly installed.

With full mountain-climbing equipment, members of the Oregon Trail Club recently climbed Mt. Osborne, the world's largest and highest sawdust pile. This 10,450,000-cu. ft. heap was accumulated as fuel for Portland General Electric's 75,000-kw. Station "L" steam plant. It is being used to stave off a power shortage in the area by supplying steam power to take the place of hydro power cut down by abnormally low stream levels. The mountain was named for Charlie Osborne, PGE's general superintendent. There is enough sawdust in the pile to run Station "L" 30 days at full capacity. It would heat 6,500 homes for a full winter season



Developing Future Rural Loads

By V. A. Bloxam

Southern California Edison Co.

HOW can future farm progress be achieved through electrical application? First, there are comparatively few "new" methods. There is very little that can be considered "startlin" in the way of products, services, or methods. We must depend upon slow development, long term trial, and gradual acceptance. The problem in the West is not line extensions for there now exists adequate territorial coverage but the real problem is to fill the hours of the day with profitable loads which are profitable for the farmer as well as for the serving utility.

A major premise defining a profitable electric load as applied to a farm could be: It is more profitable to have one kilowatt operating over a period of 24 hr. than to have 24 kw. operating over a period of 1 hr. Therein lies the opportunity to find small jobs on the farm, insignificant from a load point of view but material in kw.-hr. use. The design of equipment should, as far as possible, be adjusted to accomplish smaller connected loads and better load factors. If there is any one thing that will accrue to the advantage of the dispenser and user alike, it is this factor. Practically every utility rate schedule recognizes the relationship of load to hours of use.

More reliable equipment is available which may allow the design engineers to work electrical connected loads closer to maximum requirements. More dependable electrical service is available with the ultimate in voltage and frequency regulation, which also allows for closer design. The salesman and application engineer can and should follow through, ever with the thought in mind that lower electrical capacities and longer operating hours are the thing.

A look down the firing line will show what is going on in the field of application and demonstrate the relative importance and possibilities of various rural load activities.

In points of size and economic importance, first consideration goes to irrigation pumping. Probably less can be done to promote new irrigation pumping than any other rural load. It is almost solely the product of national or local profit outlook and available arable land. Furthermore, once established these two factors many change, making insecure the business already gained. Therefore the manufacturer of equipment and the serving utility are also gamblers in this hide and seek farming game.

What method then can be applied in order to stabilize this business? By and large the problem is one of coping with the changes (for the worse) in farm economics. Specifically it is meeting the inroads of the substitutes for electric power. The subject of competition deserves continuous study. In addition to steps for meeting direct competition, two indirect methods are strongly recommended.

First, the excellent work of hydraulic testing by utilities must be continued so that the farmer becomes wiser and wiser about pumps and their operation—to the end that he can and will demand efficient performance from the equipment he purchases—and will understand the effects of time and local changes in water conditions.

Secondly, nothing should interfere with pump improvements naturally brought about by manufacturer's competitive designs. Manufacturers, salesmen, and dealers must be urged or forced to become more competent and scrupulous in the application of pumping equipment to their customer's needs.

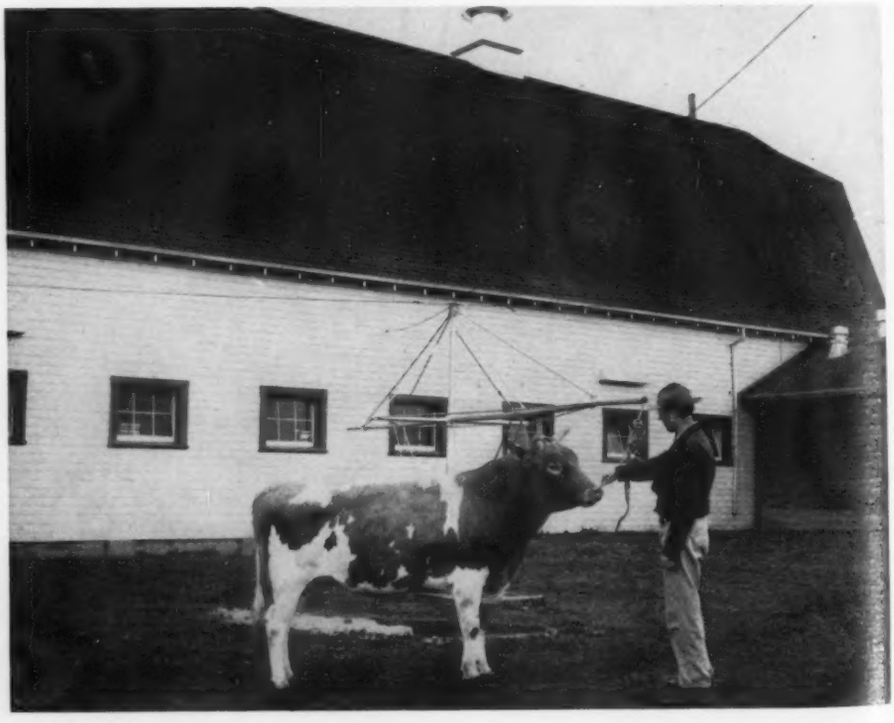
Turning to poultry, it is a fact that more than any other type of farmer, the poultryman is an experimenter. He knows more about raising chickens than his neighbor or even the old hen. He will, however, resolve his practices and conform more or less to a general average. Here is what he is doing.

First, in the eight years just passed he has gone from 70 percent fuel operation to 70 percent electric operation. He has thrown out his old hover brooders and is now using outdoor type brooders or battery brooders. The turkey man has gone almost 100 percent outdoor brooder. His brooding costs are 1 cent or less per chick. The trend is toward owning and operating his own individual incubator and away from the large commercial hatcheries. Whether this is good practice or not is a much argued question. This trend is particularly noticeable among turkey raisers.

More study and experimentation should be spent on the desirability of insulating outdoor type brooders, as greater efficiencies and better results are indicated in isolated trials.

Dairying is one of the most consistent of farming activities. Although oper-

There has been lots of kidding about electric bull exercisers. Here is one on the Middale Guernsey Farm near Vancouver, Wash. The herd sire is tied to one of the two arms extending from the center mast, which is driven by an electric motor. The exerciser leads the bull halfway around the circle, reverses, and leads him in the opposite direction. The bull hides the motor drive.



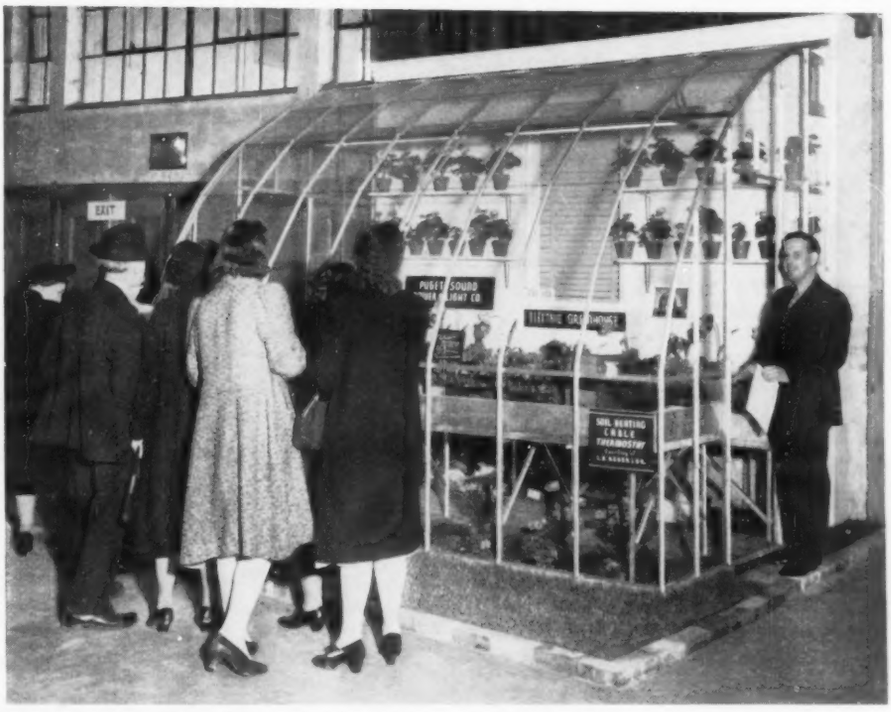
ated on a comparatively narrow margin of profit, its operating expenses can usually be adjusted to give a living wage over reasonable price changes. It is less subject to violent economic upheavals than any other economic crop. For this reason the electrical industry might well look to this field to find further opportunities for business development. For the most part, dairying is carried on in thousands of comparatively small units, each unit being a complete plant for producing milk of high quality. Over the past five years the combined agencies of California metropolitan cities and the state agricultural department have enforced regulations towards obtaining disease-free herds and sanitary milk handling plants. This work is in very competent hands.

In a farm dairy there is a constant struggle against dirt and for cleanliness. In reality this is the sole reason for all the regulations surrounding the handling of milk. Milk must be clean and free from all harmful bacteria-producing possibilities. Therefore, electrical energy, being a source of power from which all ashes, soot, smoke, smells, toxic gasses, etc., have been strained, is a "natural" for the dairy. In every dairy heat, power and light are required. There is never any question about the use of electricity for lighting and very seldom any question about the use of electricity for power. Heat, however, is usually considered to be a job for baser fuels and here is where promoters of electricity but not electricity, have fallen down.

From the dairyman's viewpoint the steam accumulator furnishes hot water and live steam at anytime and without attention. Its cost of operation is comparable with that of fuel equipment. From the utilities' standpoint its installation requires no added facilities to serve and creates no high demand but draws kw-hr. almost continuously. This is an example of the one-kilowatt-for-24-hours idea mentioned earlier.

There are some 60 or 70 of these on the Edison system alone, and without a single exception they are and have been highly satisfactory. Milking machines are used almost universally. Mechanical refrigeration for surface coolers is in quite general use, with refrigerated milk storage units in the minority in the north country and in the majority in southern California.

There exists a definite market for the exploitation of steam accumulators for sterilizing and for refrigeration whenever the regulatory requirements and the milk price differential makes refrigerated storage feasible. There also remains to be sold to the dairyman high pressure water supply, fly killers, manure pumps and adequate yard and corral lighting.



STREAMLINED ELECTRIC GREENHOUSES

The last word in an electric greenhouse was displayed at the recent National Flower Show, held in Seattle. Designed for the amateur gardner, the streamlined greenhouse is of the lean-to type, is inexpensive to build and features soil heating cable, thermostatically controlled, to provide necessary heat for plants. Farm electrification experts in charge of the display were kept busy answering numerous questions posed by prospective buyers.

In both the poultry and the dairy industries, feed is the greatest single expense. The feeding of balanced rations to produce desired results is a study which is going on continuously and which has reached a comparatively high state of perfection through the combined efforts of university research, feed manufacturers, and the farmers who use the products. Added to the poultryman and the dairyman is the beef cattle fattener and the hog raiser. With all of these, the problem of mixed feed constitutes a major activity—it is big business. It is business which rural electric men cannot well afford to discount. It is something that can be fostered and developed.

First there are the larger grinding and mixing plants to furnish feed for beef fattening which require power in the order of 75 to 200 hp. Too many of these plants throughout the country have been constructed around a diesel engine because the duty of such plants was not thoroughly understood by the owner and the electrical man's knowledge of the job to be done was inadequate. An industrial plant viewpoint and not farming viewpoint must be used in the analysis of such jobs. I know of one instance where 75-hp. electric motors were finally decided upon as against a proposed 250-hp. deisel engine. This cattleman saved over $6,000 in investment alone in not buying other machinery much too large for the job at hand.

However, by far the greatest opportunities lie in the small hog farm and the small dairy and chicken ranches. There needs to be developed and exploited small-capacity, low-priced, grinding and mixing equipment that will prepare feed of equal value with the higher priced rolling mill product, and at the same time eliminate laborious hand mixing. Here again such apparatus, if it is to stay sold, must be designed so that the cost of owning it and the cost of furnish labor to attend it and the cost of operating it are within the economic limits of the purchaser's business. Make it smaller and operate it longer hours. This will reduce the man power and the electrical operating costs. Make it efficient and make it as nearly automatic as possible. Thousands of farmers would gladly give up scoop shovel mixing.

New store of Intermountain Utilities Appliance Co., Salt Lake City, and its cooperative owners—seated: P. Monson, M. Millet, W. I. Terry, president, Betty Jensen, R. Willardson, O. R. Bigelow, manager, D. Featherstone; standing: D. Stroud, C. Packard, L. Williams, W. Cope, C. A. Rowell, C. Wygel, D Robinson, B. Melle, S. Nabaum, P. Appel, O. Spencer and S. H. Bigelow who, when the utility stopped merchandising were

"Out" but Never Down

WHEN a utility quits merchandising major appliances, what becomes of its salesmen? With this seeming trend among private utilities throughout America, the case of the Utah Power & Light Co. is typical. On Aug. 26, 1940, 67 experienced electrical appliance salesmen throughout the utility's ten divisions finished their last day's duties as utility salesmen and were faced with making a livelihood either in an entirely new field of business or of finding openings with established appliance stores.

Some became affiliated with other than retail appliance establishments; but the majority took the latter view, deciding that the retail selling game still offered fair profits to those willing to work conscientiously, and soon established themselves with department store appliance departments or specialty appliance shops.

How 13 of the 22 salesmen in the Utah Power & Light Co.'s Salt Lake division solved the problem makes an interesting story, one that compares favorably with the better-than-average run of success stories.

Deciding to set up an independent appliance sales organization, these 13 veterans pooled what resources they had and, obtaining what capital they could — some mortgaged homes and cars — established the "Intermountain Utilities Appliance Co." This particular name was selected unanimously in the belief that such a title would indicate their former affiliation with the utility.

Many observers frankly said that it would be impossible for an organization composed of so many partners to function efficiently, let alone make a fair profit. Now, after the short period of ten months, the skeptics are running for cover, the venture having proved a success far beyond the fondest dreams.

In this short time, Intermountain has risen from a small, unknown, obscure appliance shop to one of Utah's largest, finest specialty appliance stores. Originally it had a personnel of 13, now the payroll lists 21. Sales of all appliances have gained so rapidly that during the majority of months of its existence more appliances have been sold in Salt Lake City by Intermountain Utilities than by the utility during the same months of the previous year.

Originally the organization was located at 331 South Main St. This location soon proved too small, however, and on July 1 it moved into a new location at 151 South State St. The size of the new store and personnel drew much comment. "The biggest thing of its kind I've seen this side of the Mississippi," is the first thing salesmen and representatives of electrical manufacturers and distributors usually say about this new set-up when they stop in Salt Lake and view the 12,000 sq. ft. of showroom space.

Officers chosen unanimously at the time of the company's organization are all veterans of the appliance business, each having been affiliated with the utility for many years. W. I. Terry is president; O. Reid Bigelow, vice-president-general manager; Reed Willardson, secretary; Miles Miller, treasurer.

Young, energetic Bigelow, who handles the biggest share of the company's responsibility, was top salesman for the Utah Power & Light Co. for seven years. Invariably he is asked the reason for the stoer's success and promptly replies that it is nothing more than its faith in the appliance business, then points to the teamwork of the entire personnel and the complete, up-to-the-minute record files kept by each salesman of the appliances in the homes in his district, the new homes being built, those moving out of and into already existing homes.

The system of record keeping in use is fundamentally the same as that developed and used so successfully by the Utah Power & Light Co. residential sales department over a period of 29 years and is being closely followed by salesmen of Intermountain Utilities. The area of Salt Lake City is broken up into districts. Each salesman has an assigned district. He keeps a close record of all residents, if they have a refrigerator, washer, ironer—whether gas or electricity is used. Each salesman has his turn at the sales floor, and while in the field urges his prospects to "drop in when convenient and see our complete stock of Hotpoint ranges and refrigerators, RCA radios and Iron Fireman stokers."

Bigelow maintains that prices should be kept up and trade-ins down; that customers should be treated fairly and squarely at all times. "When a new customer is sold an appliance," says Bigelow, "we do not feel that the sale is final but that it is just the beginning. We keep a careful record and call on her occasionally to see if the product is giving satisfactory service. This has brought about a friendliness towards us and leads to sales of other appliances and ultimately we have installed complete electric kitchens in this way."

A factor in keeping the boys in good spirits and a cooperative frame of mind is the sales conference held every Monday, Wednesday and Friday morning. From 8:00 a.m. to 9:00 a.m. on these mornings all salesmen and office personnel gather together in the conference room and sales and financial problems are threshed out and solutions worked out cooperatively.

One of the most interesting aspects of this operation is that continued use of the prospect and customer files and methods of follow up which utilities used has been good medicine for a dealer's selling program too. It really works for anybody.

Wiring Allowances Restored

Los Angeles Bureau seeks parity for electric appliances in competitive market

RANGE wiring allowances in Los Angeles on the system of the Bureau of Power & Light have been increased as the result of a new policy "governing reimbursement allowances for wiring and installation of domestic electric ranges and water heaters" placed in effect July 1st by the Board of Water and Power Commissioners.

"We believe after a careful study you will agree that the benefits accruing to consumers as the result of the adoption of this new policy will put electric ranges and water heaters on a parity with competitive equipment," a letter of transmittal signed by Charles C. Snyder, business agent, declared to the trade in making the announcement.

The new policy provides that the Bureau will issue a reimbursement agreement certificate to the owner or occupant of a single-family dwelling, the builder of an apartment house, multiple-family dwelling or court group, to a vender of an electric range or water heater or to a school which agrees to install wiring necessary for the use of one or more appliances. The allowance is $35 for the first approved electric range or water heater installed for use and $10 for each additional such appliance, and $5 for making plumbing connections of an approved electric water heater when installed to replace a water heater of another type.

With the announcement were issued new standards for wiring such appliances to conform with the policy. Briefly these requirements call for use of appliances approved or conforming to the Bureau's specifications. Service requirements must in no case be less than for 70 amp. and the requirements also call for stubbing from the service panel or distribution center to an accessible point below the first floor for possible future connections of a water heater or range as the case may be. Meters are to be located on an outside wall and provision made for a water heater submeter. Range circuits are required to be 3-wire 120-240 volt and the water heating wiring for an approved 2-element type 240-volt heater.

Recalling the extensive reorganization and curtailment of the business agent's division at the instance of the Board of Water & Power Commissioners about a year ago (see ELECTRICAL WEST, Oct. 1940, p. 32), it will be of interest to see how the Bureau has streamlined its promotional operations to assist in the sale of electric ranges and water-heaters. Advertising has lately been increased somewhat as a general aid to dealers in promoting the idea of electric cooking and water heating. The home economics staff, although reduced, continues to demonstrate proper operation of range to the new owner, conducts cooking schools and lectures to groups of women and in cooperation with dealer promotions.

The sales force for the promotion of major domestic appliances has been considerably reduced in numbers. Direct contact with prospects by sales personnel of the Bureau is generally restricted to the new home market, through the adequate wiring approach, and in interviews with prospective home owners and builders. At the present time, due to defense housing projects and the general building activity in Los Angeles, the new home market is expanding very rapidly.

There are usually three types of contact with the prospective home owners and builders: first, the Bureau salesman; second, an inspector from the operating department to see that the range is operating properly and service requirements met; and third, upon request, a demonstration in the home by a home economist. Sales contacts with prospects in the replacement market are left to the dealer. This activity is assisted by the Bureau's advertising and other sales assistance provided through contacts between the domestic sales supervisors and specialists and the dealer's organization.

Effective sales promotion device now used in the "new home" market is a looseleaf manual which is loaned to a prospective customer by the field man at the time he makes his call. Without high pressure or specific merchandise to sell, the field man canvasses the field for range prospects on a friendly service basis from the Bureau. Where he finds interest, he talks the matter thoroughly with the man and wife and leaves in their possession for a week a copy of the manual.

When he calls back for the manual a week later, the wife is full of questions and the field man answers these patiently and thoroughly and recommends purchase from any responsible electrical dealer.

Another similar manual has been made up to leave with building contractors and speculative builders. The thought left with them is that they can

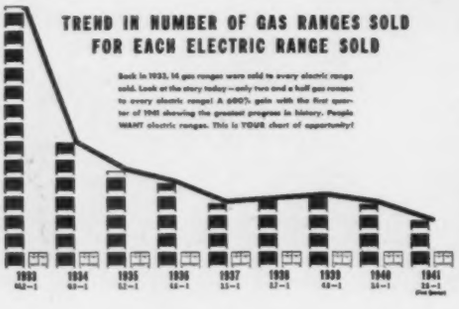
COMBINING charity with business R. M. Ralston, (left) Ralston Appliance Co., 4272 Crenshaw, Los Angeles, helped his church on a charity project by entertaining 600 women whose admission tickets paid to send 42 boys to camp. He entertained them with a complete cooking demonstration staged by Ann Martin (center), home economist of Los Angeles Bureau Power & Light, aided by his salesgirl, Helen Hodges; and with movies, including the Hotpoint picture, "Blame it on Love". The range was filled with food, in oven and on top elements, covered with celophane, cooked while the movies played, and appetizing food served afterwards to the audience. Many sales resulted immediatly afterwards. On the stage of the Ambassador Hotel with Ralston and Ann Martin are shown L. Di Angelo, G-E Supply; F. L. David, Totpoint; Rev. Glenn Puder, assistant pastor, Patricia Morris and Hubbard Russel, of the church groups in charge of the boy's work for Immanuel Presbyterian Church

use it to look up information relative to wiring and other electrical requirements and will be completely informed on the subject when their prospects ask them questions.

Make-up of the book, because it is looseleaf, varies slightly but in general it contains: illustrating meter set-ups; the advantages of built-in socket metering; range sizes with maximum dimensions so that the space may be provided in building; operating costs, analyzed both in Los Angeles and outside territory; pages containing instruction and benefit features of electric ranges; pages on rates; pages on refrigerator sizes so that space will be provided in building; data on temporary service during construction; pages on water heater sizes both of the round and square types with data on sizes and the volume of water requirements for various sizes of family; comparison pages giving comparative costs of electric and gas water heating; a page containing the wiring policy with suggested electrical specifications; a copy of the booklet "Your Home," pictures of the illuminated board which will be provided builders during the construction of the home, advertising it as an adequately wired electric home; pictures showing how meters should appear in a concealed job; modern kitchen pictures and planning service with suggestions for corner cupboards and space for the electric mixer, etc.; adequate wiring information; pages on air heating; pages on outdoor sports lighting for badminton, etc.; sometimes a copy of the booklet "Seeing" and material of a similar nature.

From such an assortment of information, all of it pertinent to the design and operation of a home, the prospective home builder or one contemplating remodelling cannot help but be influenced. Thus they are more than half sold before they seek out a dealer, the job of selling by the dealer is greatly reduced and sales resistances already have been removed.

ONE TO TWO AND A HALF is now the ratio of electric ranges to gas, says Modern Kitchen Bureau in launching the fall campaign, proving that its theme—"The Switch is on—Cooking's going Electric" is more than theory



Kitchen 'Karnival

Hales strikes patriotic note in demonstration festival

Patriotism was on the march when Hale Bros. appliance department at its Fifth and Market St. store, San Francisco, staged a colorful "Kitchen Karnival, the American Way," under the direction of Mrs. Claire Beatie, buyer of the electrical table appliance department. Registration daily averaged more than 500 and the promotion resulted in a 16% increase in sales of appliances.

Miss Golden Marble, Mrs. Claire Beatie and Mrs. Cleo Filsinger at the popular Light Conditioning center at Hale's

Mrs. Cleo Filsinger, appliance counsellor from the sales department, Pacific Gas and Electric Co., San Francisco division, assisted with home demonstrations and Miss Golden Marble assisted at the light conditioning booth.

With the predominant idea that women notice small details and appreciate them, Mrs. Beatie planned the main aisle as "American Way." All demonstrations and displays faced this aisle. Decorations were in red, white and blue on booths and canopies. Visitors had to pass 32 demonstrations to reach the Kitchen Karnival at the end of the aisle. All the sales girls wore red, white and blue aprons and special caps with stars on them to tie in with the theme.

Radio, newspaper personalities and food experts and home economics exhibits drew the crowds to a general theme promotion of "The American Kitchen—Where Life Is Better." Shopping news ads, daily and weekly newspaper ads, window displays and posters on each floor in front of the elevators announced daily prizes offered. Elevator cards invited shoppers to stop off at that floor from 11 a.m. to 4 p.m. for the demonstrations running from Monday through Saturday.

Among the grand prizes given were for the oldest electric washing machine in actual use and the oldest sewing machine. These brought forth an old wooden corrugated tub, dolly type hand washing machine, later converted to motor, in continuous use by Mrs. W. F. O'Brien since 1898. It had even been saved from the San Francisco fire and was in use the morning she turned it in. An old Wheeler and Wilson sewing machine that came around the Horn in the gold rush days won a New Home sewing machine for Mrs. Elsa Anderson, 91 years old. Registration was necessary to participate in the prize drawings and were void at the end of each day.

Similar promotions are planned for the Mission St., the Sacramento, San Jose and Oakland stores of Hale Bros. Working theory summarized by Mrs. Beatie is as follows: (1) Skits draw the crowds; (2) gay decorations interest them; (3) refreshments move them from spot to spot to see new demonstrations; (4) women see what the appliances will do; (5) prospects are made and are converted to sales.

● Farm Labor Shortages create sales opportunities for electric water systems. With this realization, the Electric Water System Council of Edison Electric Institute and the Plumbing and Heating Industry's Bureau are prepared to assist water system dealers to make the best of the opportunity and bring better living to the farm areas. A new standard manual of water supply systems is available from the Electric Water System Council, 420 Lexington Ave., New York City. It is a condensed yet very complete manual covering the purpose and operation of a water system, applications of water, sources of water, descriptions of various kinds of equipment, selection of the right equipment for the job, installations, starting and operating data, and maintenance and service information. Supplementing this are two mailing pieces, one directed to dealers to interest them in the profit possibilities of water systems; the other a consumer booklet dramatizing the services of an "able" water system and a "handy" faucet.

● New Kelvinator Dealer is the Standard Appliance Co. at Bingham Canyon, Utah. Bryan Bird and C. C. Colyan are the co-owners.

PRINT IN BINDING

ELECTRICAL WEST Sales Guide

Still No Blackout!

Quite the contrary. Light is more important than ever—for cheer, for comfort, for extra activities brought on by the emergency even into the home, for accident prevention and for protection of property.

Even in blacked-out England the authorities recognize the need for plenty of cheerful light inside homes and dwellings pust as they do to factories turning out munitions. Light is not curtailed where it won't show. In fact it is encouraged, advised, and even required.

Hardly a home anywhere but is still in need of better light for better seeing. Homes are still your best market. The house which has been completely light conditioned is still rare. Every other house is in need of lighting improvement. There is good reliable bread and butter business in just selling lamp bulbs, but there is real opportunity in the sale of **light conditioning by the room,** or the **entire house.** Turn the page—

Don't Forget Lamps---

they make

1. **Customers return often,**
2. **Store traffic,**
3. **Net profit**
4. **Sales leads** for other appliances, and
5. **Your sales increase** from

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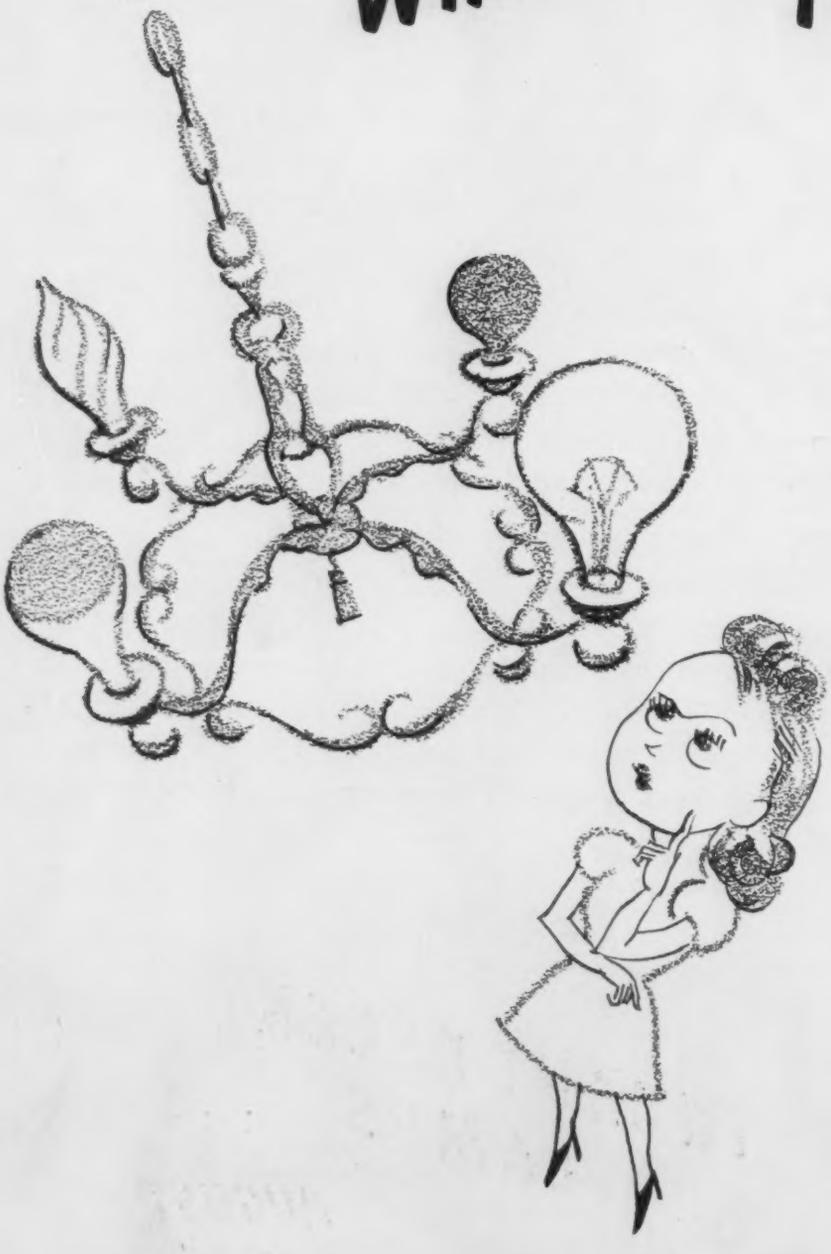
INCANDESCENT LAMPS

AUGUST 1941

Selling is fun

WHEN YOU KNOW YOUR STUFF!

What's Wrong with This Picture?



Every socket is filled, but—with what? True, something lights up when a switch is turned on but that means little. Any old socket will do that much for a new bulb.

How many homes right in your town, your own neighborhood even, tolerate such a mixture of lamp bulbs as this gal has? You'd be surprised. So used to **ignoring** the flossy old lighting fixture are we that often as crazy-quilt an assortment of lamps as these goes un-noticed. (By all but visitors and guests, perhaps.) Then the care in selecting furniture, in buying dinnerware and china, in home decoration is knocked into a junk heap by this one jarring note.

There's a real appeal to pride of appearance to be made in the sale of lamp bulbs. The proper lamp and shade are a part of the architectural beauty of the home.

Wrapping up a couple of cartons of 60 watters for a customer is nice business, but you can get much keener enjoyment out of selling the right lamps for the right purposes. That's where the fun of selling comes from, the doing of a better job. Even a counter in a dime store just sells lamps. It requires no salesperson at all. A slot machine would do just as well.

But where salesmanship comes in is in fitting the lighting to the customer's needs. There's the right size and kind of lamp for every socket, for every purpose. There are clever and artistic shades and adaptors to convert old and glaring fixtures into attractive, modern looking fixtures and yet get from them the light conditioning that people need and should have.

Even the season is with you, for schools will be starting soon, days are growing shorter, weather will soon take people indoors more. Electricity is so cheap that people can use all the light they need and want.

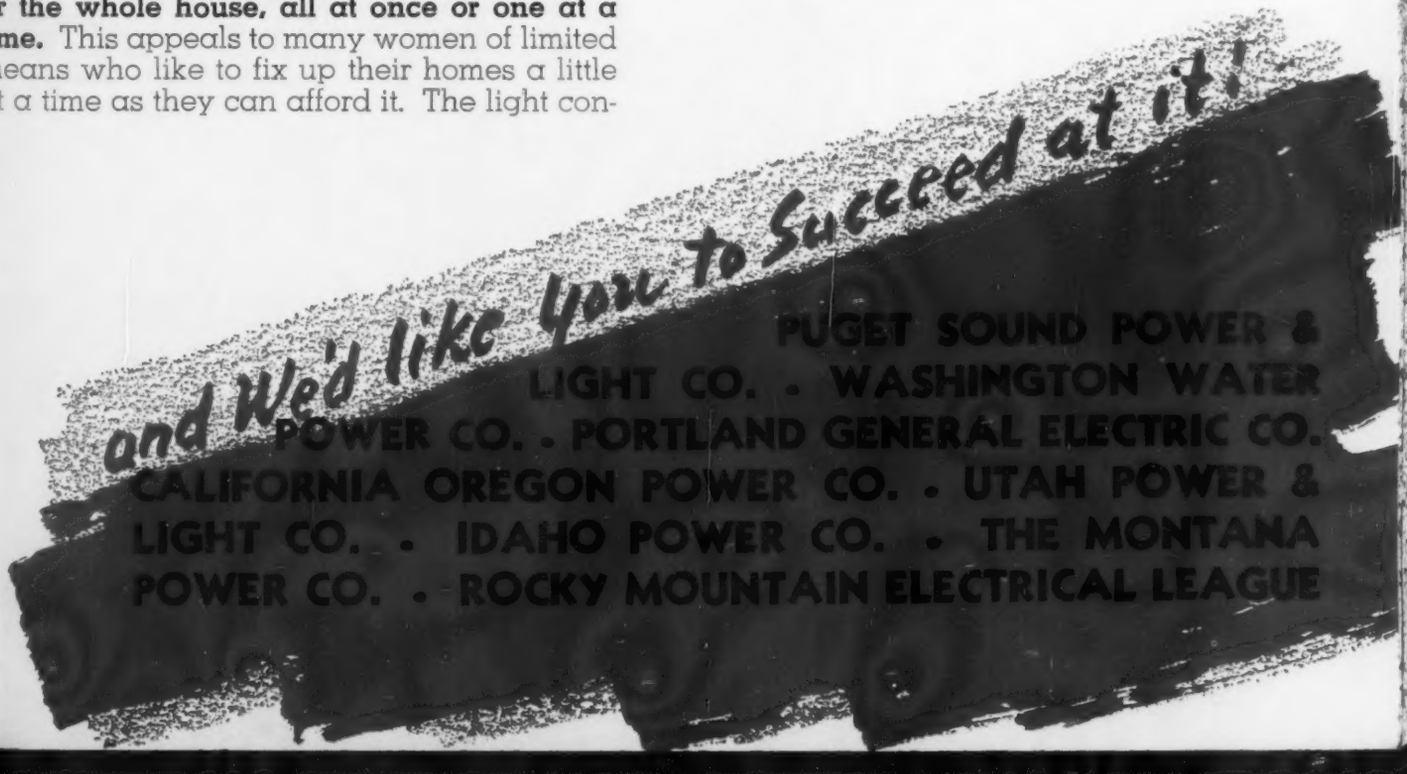
It's package goods—for it needs no installation job. A twist of the wrist does the installing. The customers do it themselves. They can take the lamps and adaptors home with them and use them the very same night—no waiting for delivery. What else has this **immediate** appeal, this instant producing of results, **visible** results?

Another sales appeal to use—**Light conditioning can be done to one fixture, or one room, or the whole house, all at once or one at a time.** This appeals to many women of limited means who like to fix up their homes a little at a time as they can afford it. The light conditioning program is one that fits this situation exactly. One room can be light conditioned for as low as $8 or as high as they want to go for new fixtures. Yet a full light-conditioning job for a home runs up close to the same gross as a washing machine, or half that of a refrigerator. It is a real sale.

Eyesight appeals are the strongest—they go straight to everyone's immediate personal interest. However, remember that many a woman will risk her own health and eyesight rather than wear glasses because of pride in her personal appearance. It is often the same in her judgment as to home equipment. She insists on appearance first. Fortunately in light conditioning equipment you can offer her **both sight saving and good looks in one package.**

Still another characteristic of human nature can work for you in the sale of light conditioning. It is this. Every woman seems to like to think she is being economical, a good buyer, a skilled shopper, even if she isn't always strictly so. It appeases her conscience on the buying of something she wants if she feels she has a real bargain for her money. With light conditioning equipment she can get such satisfying results, so much **better** lighting for so little expenditure, that she proudly talks about her purchase and becomes a walking advertisement.

These are just a few fresh slants. Use them and have the fun of selling a real lamp order.


and We'd like You to Succeed at it!
PUGET SOUND POWER & LIGHT CO. • WASHINGTON WATER POWER CO. • PORTLAND GENERAL ELECTRIC CO. CALIFORNIA OREGON POWER CO. • UTAH POWER & LIGHT CO. • IDAHO POWER CO. • THE MONTANA POWER CO. • ROCKY MOUNTAIN ELECTRICAL LEAGUE

"Stuff" to Know

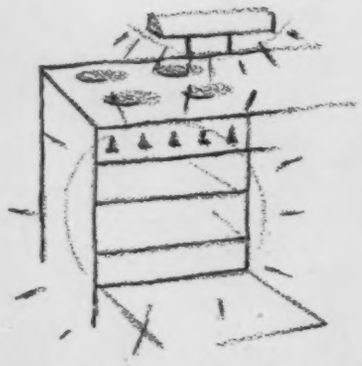
Where to get it

For such small merchandise the thoroughness of the sales help program on lamps certainly tops all others. It is really set up for volume business, and you as the outlet can swing along with this program to your profit. The large lamp companies are certainly paving the way for your sales.

Details of lamp promotion have been left out of this Guide because you can get so much from your lamp wholesaler for the asking. Display stands, posters, merchandising racks, advertising materials, sales talk, demonstration methods and gadgets—the choice is limitless.

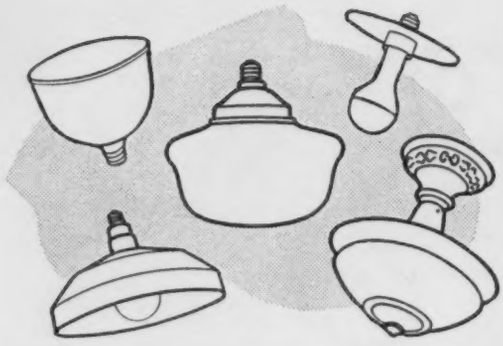
Catchy advertising is being done both by the lamp companies and the utilities. There's the "Hour of Charm" with its clever "Bulb Snatching" fun. There are Light Conditioning spreads, plus stories in national magazines. All of it points to—"see your dealer today—"

That's where **you** come in. Make that opportunity pay by selling the right lamps for the right uses, together with the right kind of light control conditioners.



Light on the Range

Electric ranges, first to be equipped with lamps, first to have lighted ovens, still have the most attractive lighting equipment. It is one of the special features of an electric range that can help you step up the sale to the better range, fully equipped. Use that clever comparison of switching from old method lighting to electric switches —and of switching to electric switches for cooking too.



Fixture Fixer-Uppers

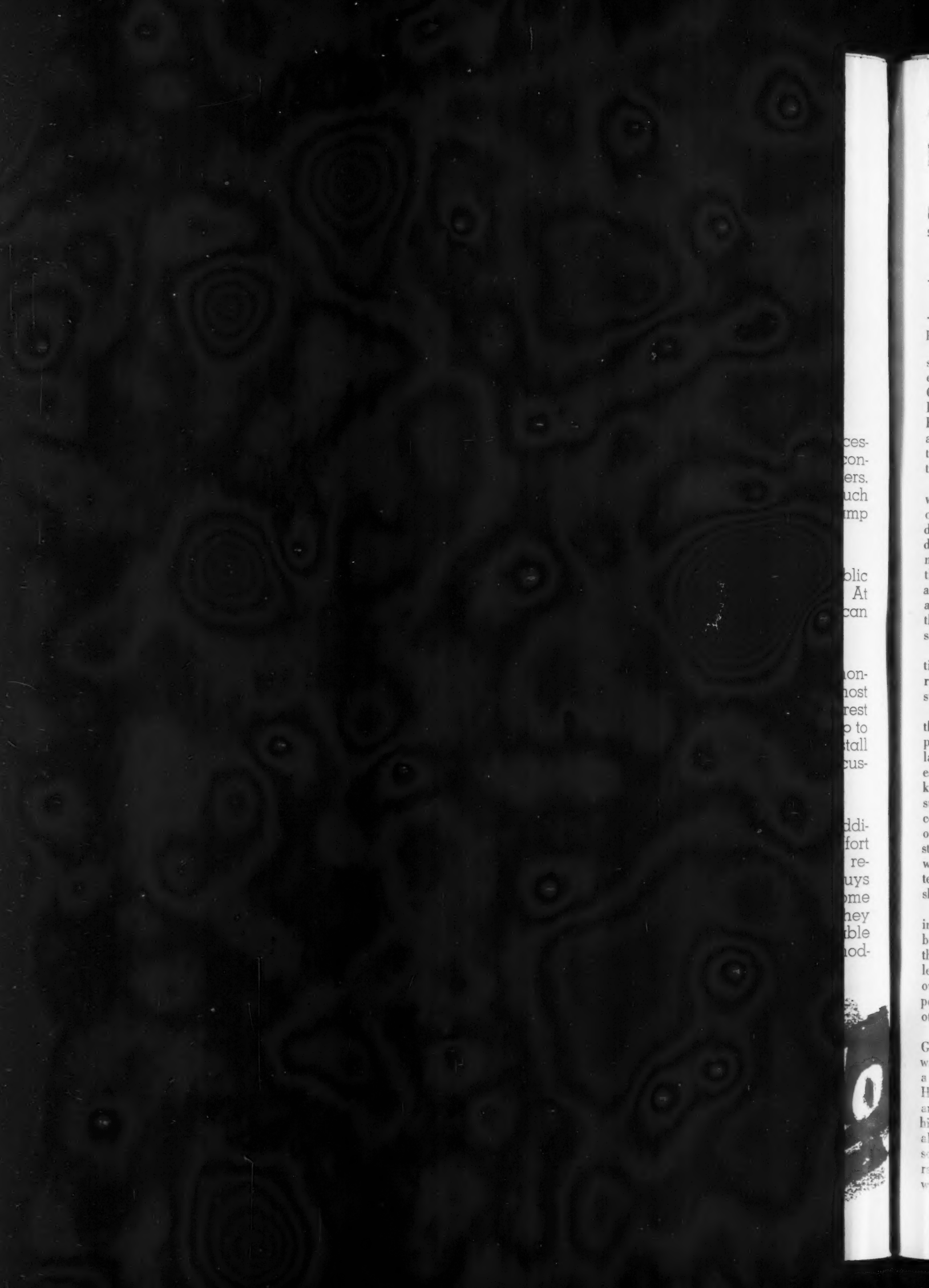
When they first came out it used to be necessary to list where you could get the light conditioning adaptors and fixture converters. Now the market is well supplied with such materials. Ask your wholesaler or lamp distributor.

Despite all the publicity, a lot of the public still do not know how they can use them. At least they are slow to visualize how they can convert their own old fixtures with them.

Whenever you sell a lamp bulb try to demonstrate at least one of these gadgets. The most successful salesmen are those who interest customers with a new gadget and build up to a sale. These gadgets are so easy to install and so effective that they appeal to the customer quickly.

Each one carries a nice extra profit in addition to the lamp sale. With such little effort they move fast, do a good job, make for repeat business. The customer who buys enough to modernize one fixture will come back for the stuff to fix up the others. They whet the appetite for better floor and table lamps, pin-to-the-wall types, even more modern complete fixtures.

"Stuff" to do



Disposals do it

Dishwashers and kitchens sold as companions

HOW do you sell dishwashers? The answer seems to be by selling, of all things, garbage disposalls.

This odd "forward pass" play in selling was discovered and developed effectively in San Diego by Walter Glass, salesman for San Diego Gas & Electric Co. and by his "backfield," Forrest Raymond, advertising manager, and Ed Meise, merchandise manager of the company, and Archie Marsden of the George Belsey Co., G-E distributor.

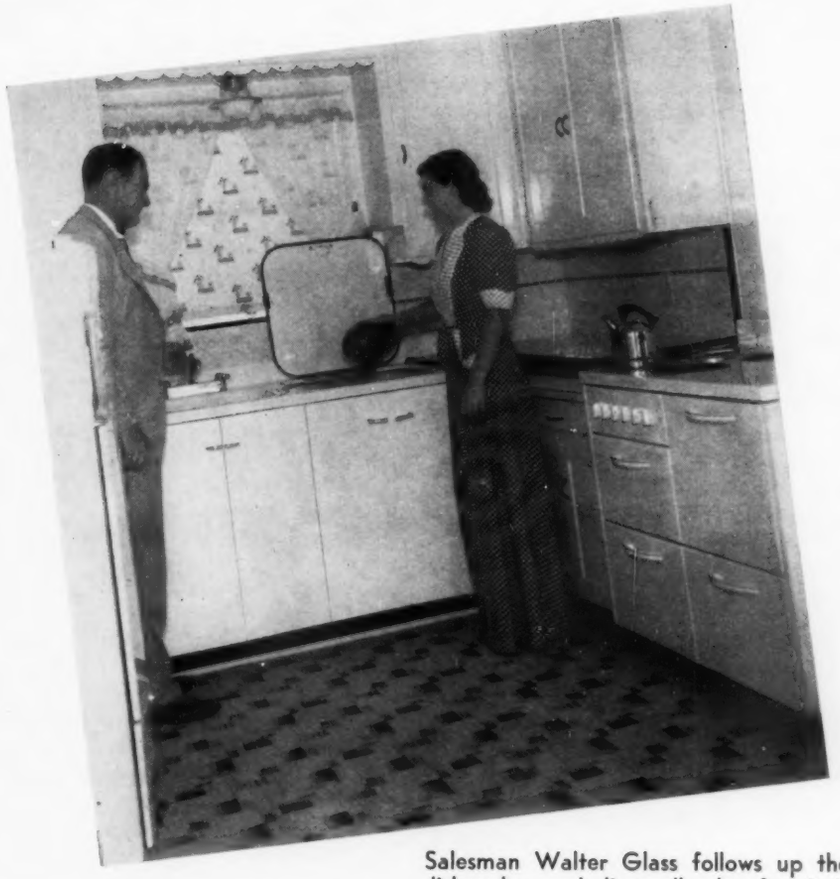
This group dcided that the dishwasher, despite its obvious desirability once it has been used in the home, is difficult to sell at first. However, the disposall seems to have much more immediate appeal. It seems to appeal to the imagination of men and women alike. Therefore, because the disposall and dishwasher are so closely related, the sale of one often carries with it the sale of the other.

On this basis a program of advertising and sales effort have been carried on in a modest way but a very successful one.

Weekly insertions of small space on the builder's page of the Sunday newspaper, Raymond felt, would reach a large proportion of the people interested in buying new homes. Space was kept small to make it more or less self-supporting by sales. The newspaper cooperated by giving publicity support on the builders' pages. Easy terms instead of price were featured; readers were invited to see a demonstration of te disposall at the utility's downtown showroom.

Supplementing newspaper advertising, direct mail was sent to architects, builders and owners of new homes at the time of issuing a permit. First was a letter congratulating the new home owner and calling attention to the disposall. Personal calls followed several other pieces of literature.

Contrary to most salesmen, Walter Glass put his major emphasis on dishwashers and disposalls. He was made a specialists on these two appliances. He now puts his complete selling effort and ingenuity into it and has found to his surprise and everyone else's that along with these appliances he often sold a complete kitchen in which a range and water heater and refrigerator went along. Now other salesmen cooperate by turning dishwasher and disposall prospects over to him to close.



Salesman Walter Glass follows up the dishwasher and disposall sale after it is installed by seeing that everything works

Sales for the first five months of the campaign were 21 disposalls, and 15 dishwashers. Thirteen of the disposalls were sold as separate units, five of the dishwashers as separate units, three as units in a sink type cabinet and eight were combination dishwasher and disposall sinks. Sales during the same time included three refrigerators, two electric ranges, one water heater and kitchen cabinets. All started from the effort to sell just the one appliance, the disposall.

Last Christmas at the San Diego Electrical Exposition, advantage was taken of the newly aroused interest in both these appliances to stage a dramatic contest between the old fashioned way of washing dishes and the modern electric way. Salesman Glass conducted this demonstration program and developed a large number of prospects. From this unique "play around left end" much "yardage" has been gained in the sale of these appliances.

● LAUNDRY CENTERS—A great number of the 4,000 odd contestants who submitted plans for kitchens in the recent McCall's magazine kitchen contest included designs for a home laundry center. Following up on this evident interest in model home laundries, McCall's has gathered together in mimeographed form 27 plans and offers them to interested parties. Copies of this bulletin may be had by writing to the McCall Corp. in New York.

Reports Trends

Deliveries this year okay, but next year uncertain

Keen in observing merchandising trends, J. Clark Chamberlain, manager of the Bureau of Radio and Electrical Appliances of San Diego County, recently returned from an extensive eastern trip and made the following significant report to members of that bureau in San Diego. ELECTRICAL WEST, which is glad to number Mr. Chamberlain among its editorial advisory board, reprints his "thumbnail report" as a guide to other dealers throughout the West. It is the appraisal of a trained observer and staunch advocate of the dealer's interests:

"Having just returned from an extended trip that took me to many important centers of the Midwest, the East and the South in search of information that might be of value to us locally,

I must confess a temporary feeling of bewilderment. In something short of a month it has been my privilege to talk to scores of men in some of our most important appliance manufacturing plants, to utility executives at various points, to men who like myself are concerned with the interests of dealers, distributors and manufacturers, and to men at Washington who seem to be making the rules of the game there days.

"In many instances, production men have not agreed as to the chances of keeping appliances flowing to the field. Certain top flight sales executives have not seen at all alike in relation to current industry problems. Opinion has frequently differed in my interviews with utility men—and it goes without saying that in Washington there is much confusion when it comes to getting facts about impending appliance industry control. But through all this seeming confusion has run a positive current of optimism. Surely we will suffer some from curtailed production, but our outlook, at least for the balance of 1941, is not anything like as hopeless as many authorities had us believing a couple of months ago.

"It is my belief that for the final six months of this year, major appliance deliveries to dealers will hold up fairly well. Shortages will occur in some lines, certain models will be entirely eliminated, but in the main we will undoubtedly continue to get merchandise in reasonable volume right through the Christmas season. And from numerous assurances, I feel certain that southern California will get at least its fair share of the production, despite the fact that other areas are already exerting great pressure to corner more than their fair shares.

"The story of industry resourcefulness in overcoming problem after problem to keep appliances rolling, has been most inspirational. I only wish every dealer could have gone the rounds with me. Impatience over shortages or slow deliveries would surely vanish after coming face to face with the conditions under which many of our most popular appliances must be made today. Aluminum, nickel, zinc, copper and several other strategic metals may be almost completely withheld from our field but still the genius of production will find a way out.

"One of the most gratifying impressions gained from factory officials was that of appreciation for the position of the dealer. From the factory standpoint, I am convinced that everything within reason will be done to help dealers remain in business and make a reasonable profit during the trying period ahead."

Awards

Washington Water Power Co. was awarded second prize, consisting of a certificate of merit and a check for $300, at the Edison Electric Institute convention. Presentation of three Geo. Hughes awards was made to electric utility companies making the year's outstanding contributions to furthering the use of electricity for cooking. The award was made personally by George Hughes, chairman of the Hotpoint company, and accepted by Kinsey M. Robinson, president of Washington Water Power. H. P. Liversidge, president of the Philadelphia Electric Co. and chairman of the Edison Electric Institute prize awards committee, presided at the awards session and judges selecting the winning companies were W. J. Daley, Roy S. Durstine Inc.; Henry Dooley, associate editor of Electrical World; and Arthur P. Hirose, McCall's magazine research director.

"Wrap em up"

A. L. McCarthy in charge of sales training for the Bendix home appliance division has concluded a triumphant tour of the West addressing large dealer meetings for the distributors of Bendix washers. With his subject, "How to Wrap 'em Up," McCarthy, a dynamic speaker with 25 years' experience in promotion work for Eureka Vacuum Cleaner Co., recounted numerous practical sales hints for dealer salesmen in the presentation and sale of appliances.

Typical of the meetings were those held in California under sponsorship of L. J. Meyberg Co., distributor; first meeting was held in San Diego July 7, Los Angeles July 8, Fresno July 9, San Francisco July 10 and Sacramento July 11.

● HITTING with appeals to immediate action, advertising in the Pacific Power & Light Co. territory for dealers and the company stresses the "Buy Now" theme and for interest catches the readers' attention with cold cooking recipes. The four appeals used are "Electricity is cheaper than ever," "Refrigerator prices still are low," "You can still get prompt delivery," "You can keep food costs down."

● CONSUMER SURVEY among farm customers and prospects, conducted by the Frigidaire customer research department, indicated beyond doubt the need for larger sized refrigerators for farm use. The need for flexible storage space to take quantities of meat or milk, beside the desire for ordinary city conveniences in refrigerators, were indicated in most of the answers.

● ANNOUNCEMENT was made that Dr. James F. Bogardus, Washington, D. C., associate price executive in charge of home furnishings of the Office of Price Administration and Civilian Supply, will address the 14th Western Furniture Conference "Industry Dinner," Tuesday evening, Aug. 5. Sharing the program with Dr. Bogardus will be Lorenzo Richards, of Boyle Furniture Co., Ogden, Utah, president, National Retail Furniture Assn. and a member of the National Retailers Advisory Board. Both speakers will present important subjects of particular interest to all retailers in these days of rapidly changing conditions.

Campaign

PACIFIC POWER AND LIGHT CO., July, complete revenue recovery drive following May 22 $480,000 rate reduction. August, clean-up program clearing the way for small lighting and "back to school" activity. In connection with the revenue recovery activity customers are receiving personal presentation folders analyzing their savings and showing the opportunities for using additional service at the same cost prior to the rate reduction.

WASHINGTON WATER POWER CO., August, continuation of residential and commercial campaign.

UTAH POWER AND LIGHT CO. and WESTERN COLORADO POWER CO., no campaigns scheduled for August. September, lighting campaign.

PUGET SOUND POWER AND LIGHT CO., July dealer roaster campaign. September, October and November, lighting, ranges, and water heater campaigns, special feature of which will be dealer programs featuring sales, educational assistance for dealer sales personnel.

BUREAU OF RADIO AND ELECTRIC APPLIANCES OF SAN DIEGO COUNTY, August, refrigeration campaign and electric range program in county territory.

CALIFORNIA ELECTRIC POWER CO. (formerly the Nevada-California Electric Corporation), August, no campaign. September, refrigerator campaign.

PACIFIC GAS AND ELECTRIC CO., July, promotion on evaporative coolers in Central Valley area supported by newspaper advertising and direct mail. Advertisements during July will support electric cooking in territories where this service is particularly adaptable.

BRITISH COLUMBIA ELECTRIC RAILWAY CO., August, annual display, including separate rural display, at Canada Pacific Exhibition, Vancouver, B. C., Aug. 25-Sept. 1. According to the company, increased difficulty in obtaining reasonable quantities of stock precludes definite campaigns during the summer months. Year around activity on electric water heating with seasonable activity on refrigerators and other appliances is being carried forward.

Shooting Trouble on Fluorescent Light

Simple test procedure using dummy starting switch will solve most cases of trouble

A need for simple, everyday test methods to service and maintain fluorescent lighting equipment was met for over 600 electricians in IBEW locals in northern California when Clark Baker, lighting counselor of the Bureau and the writer presented a two-part fluorescent lighting course. The trouble-shooting part, with the necessary basic information on circuits, is condensed here for practical, everyday use in maintenance of lamps.

By Walter Heston

Acting Manager
Northern California Electrical Bureau
San Francisco

CONSIDERING the fact that commercial development of fluorescent lighting in this country has all taken place during the past few years and that the equipment is fairly complicated, it is surprising that so little trouble has been experienced in its operation. Manufacturers deserve credit for the splendid job they have done. Yet, as everyone knows, some operating troubles do develop.

The equipment and circuits involved are so radically new and different from anything encountered before in connection with lighting that it becomes necessary for those who use, operate or maintain fluorescent lighting equipment to familiarize themselves with the principles employed if they are to cope understandingly with troubles that may develop.

Part I

The Fundamental Fluorescent Circuit

Before an intelligent approach to trouble shooting can be made, it is first necessary to have a clear understanding of the fundamental fluorescent circuit, and the equipment in this circuit. Let us begin with the lamp itself. This consists of a sealed glass tube containing mercury vapor and coated on the inside with a powder which fluoresces, or gives off light when exposed to ultraviolet radiation from a mercury arc. In each end of the tube is a tungsten filament coated with a material that gives off electrons when heated, the purpose being to facilitate starting by ionizing the mercury vapor before an ignition voltage is applied to strike the arc.

During the starting operation, these little filaments are connected in series through a starting switch as shown in Fig. 1. The function of the starting switch is to permit heating of the filaments for a few seconds. The switch then opens the filament circuit and the arc strikes.

Unfortunately a mercury arc of this kind will not operate satisfactorily unless there is some sort of a ballast, or current limiting device in the circuit. This is necessary because the resistance characteristics of a mercury arc are diametrically opposite to those of a tungsten filament lamp. That is to say, the hotter the arc the lower the resistance, and the lower the resistance the more current will flow and the hotter will become the arc, and so on. Hence,

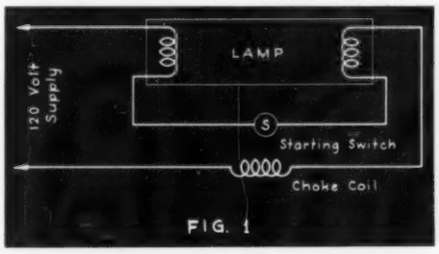


FIG. 1

without a ballast the current would continue to build up to an excessive value.

A simple resistance would serve for this ballast, but the watts wasted in heat would about equal the watts consumed by the fluorescent tube, so for the sake of efficiency a reactance or choke coil is employed. Wire wound around an iron core forms such a choke coil. This is an efficient device that impedes or holds back the current by an induced counter voltage set up in the coil of wire.

This completes the fundamental fluorescent circuit of Fig. 1. An accompanying photograph shows such a simple circuit. The top tube uses a manual starting switch, while the second tube is started by a thermal switch of the earlier types.

Two Major Objections Develop

Wide public acceptance of fluorescent lighting immediately brought about two serious objections to this comparatively simple set-up. First, was the stroboscopic effect or flicker produced because the arc practically extinguishes 120 times a second as the 60 cycle alternating current passes through zero value.

Second, was the fact that such a circuit has a power factor of only about 50%. This low power factor results from the fact that a choke coil draws a magnetizing current from the line that lags 90 electrical degrees behind the impressed voltage of the circuit. When this 90 deg. component is combined with the in-phase current taken by the lamp the resultant current lags behind the voltage, so that the power, or watts in the circuit, is no longer equal to the product of the voltage and the current, but must be multiplied by a factor, always something less than one. This factor expressed either as a decimal fraction, e.g., .5, or as a percentage, is what is known as "power factor."

This is not the place for a further technical explanation of power factor. Suffice to say that in a fluorescent circuit of 50% power factor, the amperes will be just twice what they would be if the same wattage were to be consumed in an incandescent lamp, or any other device operating at 100% power factor.

This low power factor was a serious matter indeed, involving the rate payer very definitely. It is a well known fact that all utility rates are based upon the investment necessary to serve a given area. If utilities were required to assimilate this rapidly increasing fluorescent lighting load without something being done to correct the power factor, it would mean that future rate reductions might be forestalled for years to come, and this definitely would not be in the public interest.

Obviously, if the circuit supplying a 40-watt fluorescent tube draws ⅔ of an amp. as against ⅓ of an amp. for a 40-watt incandescent lamp, then the utility must go to the expense of install-

ing static condensers on its distribution lines, or its system must carry this excess current all the way back to the generator windings. Moreover, twice the size of copper would be required in the customer's own wiring system and he too would be heavily penalized.

No injustice would be done if it were not for the fact that watt-hour meters do not measure this so-called wattless, or magnetizing current. Hence, the utility must provide the copper to carry the excess current, yet it receives no pay for it. This situation would have brought about a discriminatory rate condition as between a customer who used fluorescent lighting and one who used incandescent lighting. State regulatory bodies throughout the country quickly recognized the potential gravity of the situation and either approved power factor correction clauses filed by the utilities or instituted power factor rates on their own behalf.

The Two-Lamp Auxiliary

Fortunately, there is another electrical device known as a condenser or capacitor. A condenser charges and discharges when connected to an alternating current circuit and peculiarly enough this charging *leads* the impressed voltage of the circuit by 90 electrical degrees. It will be recalled that the magnetizing current of the choke coil *lags* by 90 deg.

The next step in the evolution of the fluorescent auxiliary was the so-called two-lamp auxiliary. Herein, the manufacturer completely solved the power factor problem and for all practical purposes whipped the flicker effect as well.

It is not meant to imply that the power factor problem could not have been solved without the two-lamp auxiliary. In the fundamental circuit of Fig. 1, the power factor can be and is corrected in commercial fixtures by a condenser, either across the choke or across the line. Incidentally, this is exactly the means that will have to be employed to correct the power factor of many of the earlier installations of fluorescent lighting to meet the power factor requirements of utility rate schedules.

Let us now look at the circuit diagram of this auxiliary as shown in Fig. 2. First, we find an auto-transformer that steps up the line voltage from 115 or 120 to somewhere around 200 volts. Lamps of the 30, 40 and 100 watt sizes require higher voltages across the lamp terminals, and also higher starting voltages and it was found desirable to make use of an auto-transformer to obtain most satisfactory operation. Two lamp auxiliaries that do not contain an auto-transformer operate essentially on the same principle as those with auto-transformers.

Lead Lamp Circuit

Next, it will be seen that each tube has a circuit of its own. The upper tube in Fig. 2, is the so-called lead lamp and operates through a choke and condenser in series. The values of inductance and capacity in these two devices are so chosen that the line current taken by the lead lamp circuit, leads the line voltage by approximately 48 deg., and hence the power factor of lamp and circuit is about 67% *leading*. When the two-lamp auxiliary was developed, it was found that the starting current of the lamp, which is about twice the normal operating current, produced so much voltage drop due to the series condenser that the lamp had difficulty in starting. This was overcome by introducing a starting compensator, or choke coil, in that part of the circuit which contains the starting switch. This compensator is to introduce more inductance in the circuit during starting only, to help counteract the effect of the over-

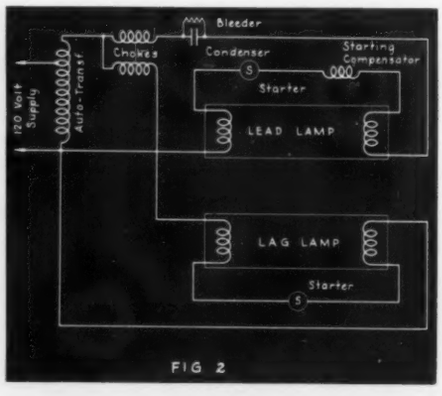


FIG 2

size condenser used to obtain the large component of leading current during normal lamp operation. The effect of this starting compensator is then to produce a higher filament current and insure proper preheating during starting.

One other thing is to be said about the lead lamp circuit. There is a small bleeder resistance shunted across the condenser to drain off any charge that might remain stored in the condenser when the circuit is de-energized.

Lag Lamp Circuit

As for the lag lamp circuit, it will be seen that this is essentially the fundamental circuit of Fig. 1. Its power factor is about 50% lagging, i.e., the resultant current lags behind the voltage by about 60 deg. Now, when the leading current in the one part of the auxiliary circuit is combined with the lagging current in the other, the resultant of the two is had in the line feeding the unit as a whole. This brings the line current nearly in phase with the voltage, resulting in a line power factor of about 98%, which is entirely satisfactory to everyone concerned.

Solving the power factor problem in this manner was done by design and not by happenstance. It is evident from the foregoing that the current in the two lamps operating on a two-lamp auxiliary are approximately 108 deg. out of phase with each other. This means that when the current in one lamp is passing through zero, or the dead light spot, the current in the other lamp is at its near maximum and that lamp is giving near maximum light output. Thus, the current never passes through zero value in both lamps at the same time. The combined or mixed light from the two tubes acting as a single source is in this manner devoid of any objectionable or harmful flicker (stroboscopic effect).

Starting Switch

One other piece of equipment, the starting switch, should be discussed before taking up trouble shooting. This performs an important function in a piece of fluorescent lighting equipment, and unfortunately it gives some trouble.

The thermal switch and the glow switch are the two types in general use at the present time.

The thermal switch consists of a bi-metallic strip that is heated by passage of the filament current through it. After about two seconds, its contacts are opened, the arc strikes and the tube lights. One of the latest of these switches to appear on the market has a ¼-watt heating element which remains in circuit in parallel with the fluorescent tube. The small amount of heat dissipated by this tiny heater serves to prevent the bi-metallic strip from cooling and re-establishing the circuit through the filaments. Otherwise, the starter would continue to function over and over again.

The most widely used starter is the familiar little neon glow switch. This consists of a bi-metallic contact strip sealed in a small glass tube which contains neon gas. The contacts of the switch are open when the circuit is dead. When the fluorescent lighting unit is energized a voltage is impressed across the terminals of the starter as will be evident by referring to any of the accompanying wiring diagrams. Neon gas is a conductor, so a current flows through the gas between the two sides of the circuit within the tube. This heats the gas and causes the bi-metallic strip to bend and close its contacts.

The metallic path thus established through the switch causes the current to cease to flow through the gas and the bi-metallic strip cools and breaks its con-

tacts. At this instant an ignition voltage is impressed across the tube and it lights. The starting switch is now shunted across the mercury arc path in the fluorescent tube, and since the mercury arc path is of low resistance as compared to the path through the neon gas in the starter, there is insufficient heat produced in the neon gas to cause the bi-metallic to re-close its contacts and thus re-cycling is prevented.

The glow switch starter is a unique device but like all starters it is a delicate device and sometimes gives trouble. Manufacturers are still devoting a great deal of research to further improvement in starting switches and to their possible elimination altogether.

Part II

Trouble-Shooting Suggestions

Having laid a proper background we may now turn to a consideration of operating troubles. It is desirable to determine insofar as possible the nature of the trouble before opening up the fixture to get at the auxiliary or before taking the fixture down where it can be worked on.

A surprising amount of information can be gained by access to the starting switch socket only.

It is suggested that an old starting switch be dismantled and two leads brought out through the top of the switch can and that this be kept as a permanent piece of test equipment. This device is shown in one of the accompanying photographs.

Insert this dummy in place of the regular starting switch. Touch the ends of the leads together. If the filaments in the tube glow, allow them to burn for several seconds and then *quickly* break the contact. If the tube lights, then look for trouble in the starting switch. If the tube flashes but does not light, then it is likely that it has served its useful life and must be replaced. However, it is quite possible that failure of the tube to light is due to low voltage on the circuit. This may be determined with a voltmeter. Fluorescent tubes are rated at 118 volts and trouble may develop in their operation if the voltage falls too far below this value.

When the leads from the dummy starting switch are touched together, if the filaments do not burn, then any one of several things may be the cause of the trouble. First, and mostly likely, is that there is an open circuit in one of the filaments, or poor contact in a socket. Replacing the tube will check this. Another procedure is to remove the tube and short the two terminals of each socket with a "U" shaped piece of wire. Or better still, break the ends off a burned out tube and twist the two wire prongs together so as to short the two terminal pins. Wrap a piece of tape spirally around the metal rim to prevent cutting the hands on the rough glass edges. This piece of test equipment will be found very useful in shorting out the sockets in the fixture and together with the dummy starting switch, are good pieces of test equipment to have on hand. These sockets ends are shown in the photograph with the dummy switch.

When the fixture sockets are shorted out, the whole circuit is continuous right through to the terminals of the starting switch, as will be evident from Fig. 1 and 2, providing everything is in working order. *Do not touch the leads from the dummy starter together under these conditions, as this may damage the auxiliary.* Instead, connect the leads to a 220-volt test lamp or voltmeter. The voltage on the lamp or voltmeter will be somewhere around 200 volts on a two-lamp auxiliary of the usual auto-transformer type.

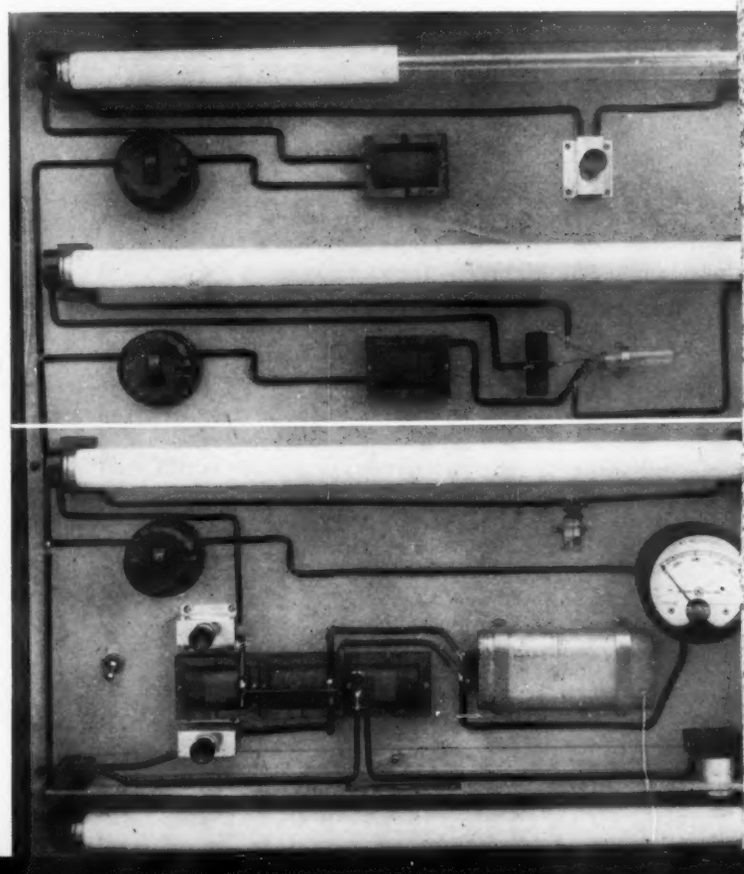
If there is no current on the lamp or voltmeter, then any one of three things may be wrong. (1) the circuit feeding the fixture may be dead. (2) the auxiliary may be burned out, or (3) there is an open circuit somewhere in the wiring. If test shows that the circuit is energized, then perhaps an inspection of the auxiliary and wiring can be made with the fixture in place. If a test across the two line terminals of the auxiliary shows that the circuit is hot up to that point and no loose connections can be found, then replace the auxiliary as the trouble is undoubtedly in it. However, do not be too hasty in replacing the auxiliary until it is certain that some loose connection, poor contact or open circuit has not been overlooked.

Operating Problems

When only one tube of a two-tube unit will light. This may be due to a burned-out starter; a burned out tube; poor contact in sockets; or an open circuit in part of the auxiliary or its connections. If none of these are the cause of the trouble, then it will usually be found that the lamp in trouble is near the end of its life or there is low voltage on the circuit.

When a tube flickers, cycles or pumps. When a tube goes on and off or cycles, the trouble may be in the starting switch. If this cycling is allowed to continue, the tube will be damaged and may be ruined due to the fact that the electronic material on the filament is rapidly driven off by repeated attempts at starting. Or if the tube has already served its life, then the starter switch may soon be damaged. If a new tube is installed, make sure that the starting switch functions properly. It is not uncommon to find both the tube and the starter burned out at the same time.

By far the most common cause of cycling is a lamp that has served its useful life. Every few seconds the starting switch functions to start the tube, but the arc will not strike and a flash is seen at the ends of the tube. If this



Illustrating the fluorescent circuit in diagram as set up on a display board. Top shows the fundamental fluorescent circuit with choke coil and manually operated switch. Next is the same circuit with the thermal switch opened up.

Below the white line is the conventional two-lamp circuit, with a miliameter in the line

condition is allowed to continue, the contacts in the starting switch may weld and the auxiliary may then be damaged from the high current taken by the starting filaments. It will be recalled that the starting current is about double the lamp current and the ballast may not have been designed to carry this high current for any period of time.

When a tube flutters, snakes or spirals. This may happen even in new tubes and usually will cease after a few hours of burning or seasoning, or it may be caused by a poor start due to insufficient pre-heating of the filaments. Try another starting switch or start the tube manually by using the dummy starter as above described. Another very likely cause of flutter or spiraling is low voltage. Be sure to check the voltage at the fixture. A cold draft on all or a part of the tube also may cause this trouble. However, many cases will be found where everything is absolutely normal and a tube will still flutter or spiral. Of the very large number of fluorescent tubes being manufactured a small percentage will develop a peculiarity of this kind after being in service for a time and there is nothing that can be done about it except to weed these tubes out and replace them.

Filaments burn continually and tube does not light. This usually is due to stuck contacts in the starting switch. Replace starter, as this condition if allowed to continue will overheat and may burn out the auxiliary, because as already mentioned, the starting current is about twice the operating current of the lamp and the auxiliary may not have been designed to carry this current for any period of time.

Critical Voltage. All equipment in a fluorescent circuit is inherently critical to some degree and for any given combination of auxiliary, starter and tube there may be a critical voltage at which unsatisfactory operation results, yet the individual pieces of equipment in themselves may be perfectly all right. Before discarding a lamp or starter, it is suggested that they be tried in another lighting unit where the critical condition may not exist.

Tubes Blacken at Ends. Blackening at the ends of fluorescent tubes is a normal condition, although the rate of blackening and the rings and patterns formed are often indications of improper starting conditions or improper supply voltage. There is little the maintenance man can do about it except to check line voltage and starter operation.

Hum from Auxiliaries. Sometimes an auxiliary will emit an objectionable hum. Try mounting it in rubber. If this or other expedients fail, there is little that can be done save to replace the auxiliary.

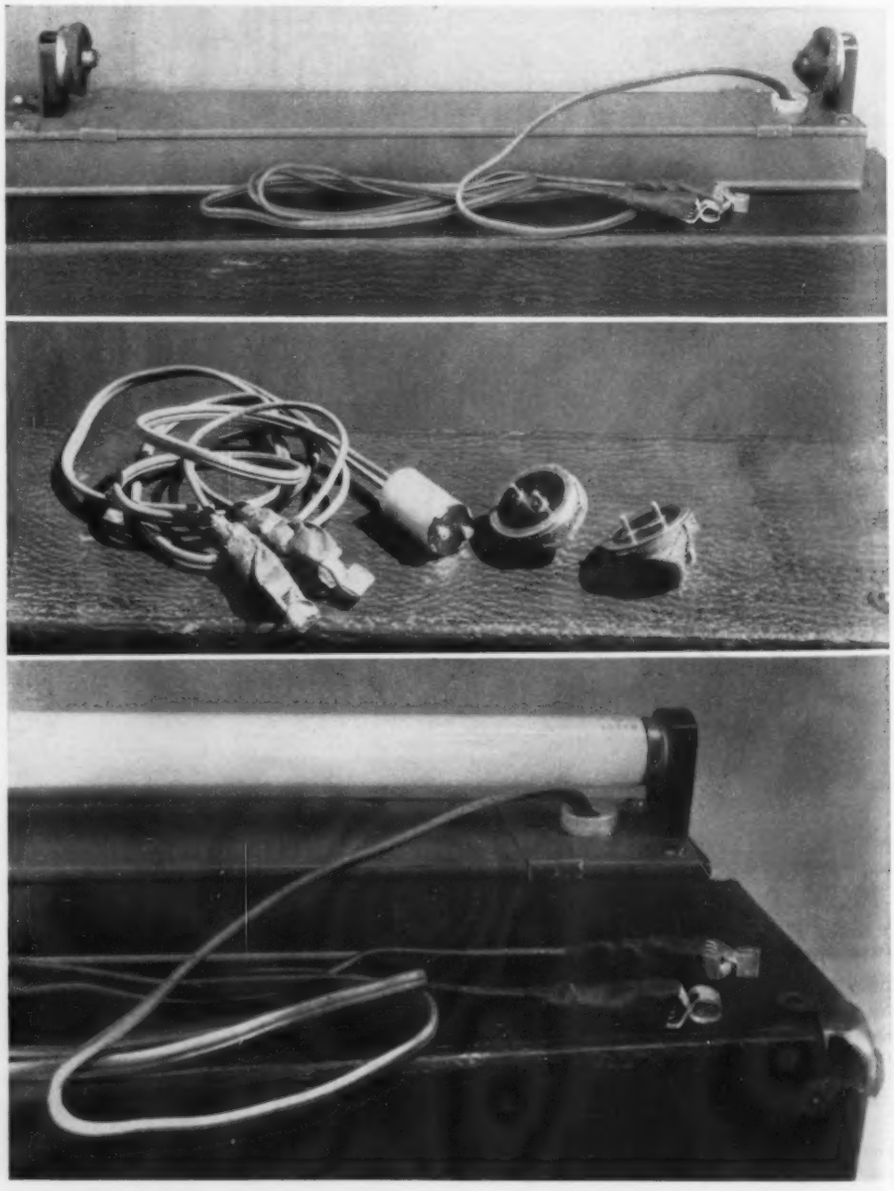
Radio interference. Some complicated cases of radio interference may arise. For trouble of this nature, consult manufacturers' special bulletins or call a radio serviceman.

New installations. In new installations, it is advisable to test out each fixture before it is hung, as this may save trouble-shooting later.

Caution. In any case of improper operation or trouble with fluorescent equipment, it is very important to make sure that the auxiliary is of the right type and size for the particular tubes involved. Also, be sure that the starting switch is of the proper size. There are several sizes of starting switches.

Suggestion. It is suggested that those who may have occasion to maintain fluorescent lighting equipment thoroughly familiarize themselves with the whole subject. Review Part I of this presentation. Study wiring diagrams and learn the fundamentals.

Handy gadgets for the trouble-shooter's kit, and easily made up by any electrician, are a pair of short-circuited lamp terminals and a dummy starting switch from which two leads are brought out to a pair of test clips. Pictures below show: (top) lamp terminals and dummy switch in use, (center) a close up of these gadgets (note tape on lamp terminals to protect fingers from edges of broken tube glass), and (bottom) dummy switch as used when testing with lamp in sockets



LIGHT for a WAITING ROOM

Fluorescent

The Need

Pleasing lighting so designed as to give an appearance of modernity and efficiency to an airport waiting room, and enough light for casual reading, etc.

Conditions

Space 45x25 ft., (1125 sq. ft.) with a 10-ft. ceiling. Walls in light tones.

Installed

Coves containing 10 40-watt fluorescent lamps each formed by parallel beams across the ceiling. Total wattage 1600, or 1.3 watts per sq. ft.

Results

Uniform and pleasing level of illumination throughout the area of 10 ft. candles.

Who

Airport terminal waiting room of United Air Lines, at Spokane, Wash.

LIGHT for a CATHEDRAL

Incandescent

The Need

Unobtrusive, dignified illumination without hanging fixtures, and yet sufficient for the reading of fine print in prayer books. Over the altar heightened lighting, yet not theatrical.

Conditions

High center area with light walls of good reflection factor, dark beamed ceiling not to be lighted. Side areas as shown in diagram.

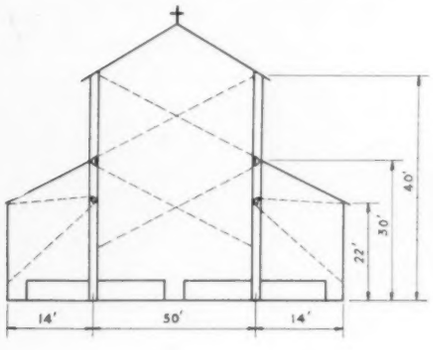
Installed

Mounted behind plaster rings with slightly frosted glass covers, 78 200-watt Curtis 60-33B adjustable floodlights aimed so as to reflect against opposite wall but so that no direct light would descend to the line of vision or up to the beamed ceiling. Altar lighted by 15 short-necked outdoor type 150-watt reflector spot lamps mounted on Curtis strip along front edge of a 13x7x3 ft. canopy 21 ft. above the floor. Stations of the Cross lighted by a concealed 40-watt lumiline lamp in a niche below each picture.

Who

St. Joseph's Cathedral, San Diego, Calif. Bishop Charles F. Buddy. Illumination design by collaboration of A. I. Benedict, Illuminating Engineer, San Diego Gas & Electric Co.; Earl Rice, Coast Electric Co., and California Electric Works, electrical contractor.

Diagram illustrating placing of lighting units and approximate beam cut-off



ELECTRICAL WEST

McGRAW-HILL COMPANY OF CALIFORNIA
68 POST ST. SAN FRANCISCO

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While We Still Have a Voice

IN THE FACE of news from Washington, D. C., that pressure is to be put back of passage of the Columbia Power Authority bill sponsored by Secretary of the Interior Ickes, it is refreshing to see the almost universal condemnation of this measure by the newspapers of the Pacific Northwest. Of all observers of the local and national scene, the press is in the best position to appreciate fully the social, economic and political implications of the power grab contained in this obnoxious, deceptive and un-American legislative proposal.

Editors see clearly the dictatorial control that would be exercised by federal totalitarians in the nation's capital on the economic life of the area. Like President Coolidge, they know that no man, region or nation can surrender its economic independence without sacrificing his or its political independence. Not only would the proposed bill with its $200,000,000 revolving fund wipe out the private power industry of the Northwest, but it would set up an agency that could decide what firms or communities could receive power, how much each should get and how much they should pay. It imposes compulsion upon non-public ownership communities to come into the fold. It would create a super-gigantic federal power monopoly that could and would dictate to all of its customers.

Some editors and a few men high in government here in the West appreciate that this power grab is but part of a master program to usurp many of the rights of liberty-loving Westerners. Absolute control over water flowing in Western streams, over mineral rights, grazing, forests and other resources is part of the plan, as Governor Carr of Colorado has been warning the people of all Western states.

Point of all this is that if the people and the press want to give consideration to this trend toward federal absolutism and bring it forcibly to the attention of Congress, they had better use their voice while they still have a voice.

Vexing Priorities

PROBABLY no single regulatory invasion of business and industry has caused more headaches than the system of priorities imposed by national defense. As the pinch of diminishing supplies of essential defense materials becomes tighter, confusion among both customers and suppliers becomes greater. Because so many of the materials used in the electrical industry have been put under some form of priority control, the position of the user whether he be ultimate consumer or manufacturer becomes more and more perplexing.

Obviously the situation will work itself out. Already priority status has been provided for materials and equipment required to maintain existing electrical facilities in a satisfactory operating condition. Also requirements for defense housing have been assigned priority ratings. Still to be reckoned with are the normal bread-and-butter items necessary for every day operation of power companies and for the daily business of manufacturers and contractors. Since electric service is so essential to the successful accomplishment of the defense program, it is to be expected that such items will finally receive priority consideration. In the meantime the best thing that can be done is to adopt a philosophical attitude like the electrical manufacturer who sent the following to all of his customers under the heading, "We Ain't Mad at Nobody":

"Just because an old, valued supplier don't give us the service he used to—we ain't mad. We know that he's doing his best, that he values our account, and realizes that he'll need us when this crazy period is over as much as we now need him.

"Also if some friend should give us hell because of the service we're giving him—service we too don't like—we ain't mad. We know he's trying to do a tough job too. We know he realizes what we're up against, that we're doing our best and that we know we'll need him just as much later on as he needs us now. So if you don't mind, we'll all just keep plugging along 'on the beam.' "

Ranges Are NOT Luxuries

WHEN a number of prominent individuals allude to electric ranges as "luxuries" which are displacing defense production" and when legislators class this appliance as a luxury warranting a special exise tax, then it is time for the electrical industry to muster a counter barrage. And when a well known columnist refers to the 51% increase in sales during the first six months of 1941 as a "scandalous boom," then something has gone wrong with the industry's elcetric cooking story.

If an electric range is a "luxury," it is only because it provides so many advantages over old-fashioned cooking methods. A $100 investment in an electric range—not high as modern stoves are priced—gives the housewife such advantages as safety from fire hazard, conservation of vital food elements through control of cooking heat, savings in food waste by the same means, cleanliness, operating economy and conservation of time, health and energy. No housewife will admit that an appliance which brings her all these benefits is a luxury.

Then there are 8,500,000 more homes wired for electricity than there are piped for gas. Would the occupants of these homes, many of which are in rural areas, classify an electric range as a luxury?

Paradoxically electric ranges have been standardized for both navy and marine service. Many of the defense housing units are equipped with electric ranges also. Do the government agencies charged with administering these activities class electric cooking as "luxurious?"

If given an opportunity, electric range manufacturers will make all necessary sacrifices to the defense program. Already they are replacing many of the vital metals formerly used with new materials. And research laboratories are working at top speed so as to reduce further the use of essential defense materials.

These are facts which might influence the immediate future of the electric range business if the industry will only bring them before the right people. Otherwise scarcity might make the range a luxury. It's the only thing that can.

Small Business and War

NEITHER individual man nor individual business means much when mass action is demanded in such sweeping emergencies as war. Yet, despite such relative submergence of the individual, it is still the fight and resistance of the individual in the mass that makes the mass action strong.

In contrast to the swirling pressures in America to ready itself for the emergency, the level-headedness of the British government is a source of admiration. Here business is being tossed hurriedly into the pot, almost as though those in charge of national affairs were glad of such an excuse to liquidate it, but in England there is real concern on the part of the authorities to keep business alive, to stimulate it and coddle it a little for eventually it must be that which restores order and pays the bill.

One of the irritating and confusing influences today to all men of experience, is that so few if any at all of the techniques of cooperation and business success are being used, or even permitted, to aid the nation. Associations of business men have done so much to improve not only business but living standards. Yet efforts are being made to dissolve and break up associated effort. In England, quite the reverse.

Small business of itself can contribute so little to the nation, but through associations it can do so much. What a pity to destroy this one means whereby it too can do its part.

I BELIEVE in the supreme worth of the individual and in his right to life, liberty and the pursuit of happiness.

I believe that every right implies a responsibility; every opportunity, an obligation; every possession, a duty.

I believe that the law was made for man and not man for the law; that government is the servant of the people and not their master.

I believe in the dignity of labor, whether with head or hand; that the world owes no man a living but that it owes every man an opportunity to make a living.

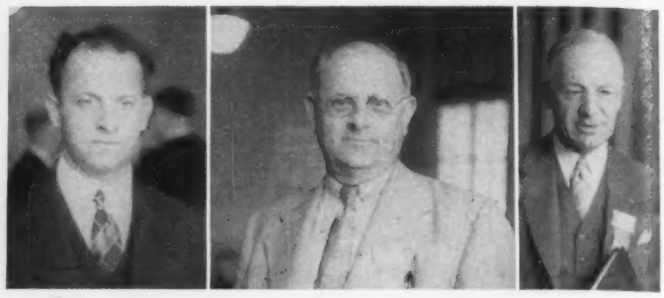
I believe that thrift is essential to well-ordered living and that economy is a prime requisite of a sound financial structure, whether in government, business or personal affairs.

I believe that truth and justice are fundamental to an enduring social order.

I believe in the sacredness of a promise, that a man's word should be as good as his bond, that character—not wealth or power or position—is of supreme worth.

I believe that the rendering of useful service is the common duty of mankind and that only in the purifying fire of sacrifice is the dross of selfishness consumed and the greatness of the human soul set free—John D. Rockefeller, Jr.

IAEI PRESIDENTS—Otis W. Newcomb, Southwestern; I. B. Sturges Northwestern Section; George Kimball, International



AND SECRETARIES—Harold Gerber, Southwestern; Fred D. Weber, Northwestern; and Victor Tousley, International

Inspector Conventions to Touch Vital Issues

Two more nationally known speakers, each with a topic of exceptional interest to inspectors and contractors, will be squeezed into the program of the Southwestern Section, International Assn. of Electrical Inspectors annual meeting at San Jose, Aug. 25-27, according to last minute word from Harold Gerber, secretary of the Section.

Howard Weber, commercial engineer for U. S. Rubber Co. who last year talked of the new wires and their applications, will return with a talk keyed to the present emergency, "Wiring Methods and the National Defense Program." Tentatively, its place on the program has been set for Wednesday morning, Aug. 27.

By popular demand from those who have heard him, A. B. Smedley, now Los Angeles manager for Anaconda Wire & Cable Co., will give his demonstration and informative talk, "Copper and Kilowatts," at the Monday noon luncheon. In it he covers the reasons for the demand for more adequate wiring, comparisons of 1937 and 1940 codes, the interim proposals on Article 3005, why cables should be paralleled, power factor and "talk in the language of the layman."

Other speakers on the program remain as announced last month. The entertainment will include an outdoor barbecue, Monday evening, a dinner-dance Tuesday evening, and a tour on Tuesday afternoon. Dinner-dance entertainment "highlights" will be a performance by W. A. Cyr, ELECTRICAL WEST, of his "fluorescent fantasy," "So Watt and the Seven Whites," especially revised for the inspectors.

Meeting jointly with the inspectors on Tuesday will be the Electrical Contractors Assn. of Northern California, which will have a business session in the afternoon of its own, sharing the program in the morning with the inspectors.

Otis W. Newcomb, president of the Southwestern Section, is chief electrical inspector of Long Beach, and past chairman of the Southern California Chapter.

Northwestern

Color motion pictures taken last year at the Great Falls meeting of the Northwestern Section, International Assn. of Electrical Inspectors, will be shown as a special treat at the annual dinner-dance of the same Section's annual meeting at Tacoma, Sept. 2-5. Taken by J. W. Whittington, chairman of the public relations committee of the IAEI, New York City, they will bring back memories of one of the most colorful of conventions in the West.

Few changes from the outline of the convention program in last month's issue have been made, according to F. D. Weber, secretary of the Section. Mostly they are changes in the time of certain of the keynote speakers.

G. A. Sawin, director of regulatory legislation dept. of NEMA, New York, will speak on "State Electrical Bills," on Thursday afternoon, instead of Tuseday. George Wisting, assistant manager in charge of business development, Northwestern Electric Co., will deliver his address, "A Quick Look Around," on Thursday morning instead of Wednesday afternoon as previously mentioned.

Among the special committees to report were mentioned those on wiring for outdoor and field lighting, and another on auto and trailer camp wiring, to be presented by L. W. Going, of Portland, and E. E. Lee, of Seattle, respectively. Another of particular interest will be the report of the committee on "Special Code Treatment for Rural Districts," to be made by W. R. Volheye, Oregon state electrical inspector.

Interesting facts concerning the career of I. B. Sturges, president of the Northwestern Section, are given in the convention program. Born in Portland, Sturges had considerable telephone experience up to 1908, then utility power plant construction until 1912 when he became an electrical contractor. In 1918 he became a deputy electrical inspector for the city of Portland, and in 1934 was assigned the sales control provisions of the Portland code to enforce. He has been active in committee work in the association and a member of its executive committee for some time.

W. L. Gaffney, chief electrical inspector of Tacoma, host to the convention, promises an extra special treat on Wednesday night of the meeting when the entire group will be taken to Point Definance Park for an outdoor clam bake. The convention sessions will be held in the roof garden of Hotel Winthrop, Tacoma.

RMEL at Estes

Long range preparedness to be convention theme

The electrical industry will be projected fifteen years into the future at Rocky Mountain Electrical League's annual convention, to be held in Estes Park, Sept. 11, 12 and 13.

A program, now in preparation under direction of G. B. Buck, president of RMEL, contemplates post-war problems to be met by private power companies. Such long-range planning, Buck believes, is necessary to provide an outlet for enormous energy reserves now being developed in national defense preparations.

Military experts predict a 10-year war. During that period all resources of the United States will be dedicated to the production of armament, ordnance and guns, with the aid of tremendously increased power facilities. When peace comes — as it must eventually — what

will become of the unprecedented electric potentials that must be channelled into useful service, or written off as complete loss? Suppose the war will last only two, three or four years? Will electric utilities return to intensive merchandising promotion; or can the merchandisers organize to take up the slack between post-war consumption and production of electric energy? Must new business-developing agencies be formed, with government and private enterprise collaborating; or can existing groups step up their efficiency to whip the coming emergency?

These questions will come up for answers at the September convention which, as in previous years, will have headquarters at the Stanley Hotel. Correspondence passing across the desk of George E. Lewis, manager of the RMEL, forecasts a record-breaking attendance, because of the down-to-brass-tacks agenda.

Contractors' Dilemma

Caught in a pincer as relentlessly as by a Nazi panzer drive, electrical contractors face financial starvation at the hands of the present defense program unless their talents and experience are permitted to be enlisted in the construction itself. The reality of this situation last month caused two special contractor meetings to be called by the officers of the Electrical Contractors Assn. of Northern California and the San Francisco Bay Chapter of NECA.

At the chapter meeting, held July 2, in San Francisco, Clyde L. Chamblin, California Electrical Construction Co., its chairman, outlined the NECA's machinery to assist the contractors in such problems heading up in Washington, D. C. It was then urged by several, themselves members of both organizations, that efforts be made to merge the Northern California association and the Chapter again under a new chapter for the region, strengthen the hand of NECA in its representation of the West, and seek immediate action.

Following up on this suggestion a special meeting of the Northern California association was called by President Dan Bronson in San Francisco, July 18. The problem confronting contractors was briefly summarized as follows:

"1. Virtually all work heads up in Washington, D. C., either directly or indirectly as a result of the defense program.

"2. Practically all such work in the West is being let to general contractors on a cost-plus-fixed-fee basis, with implication that the general contractor do the entire contract rather than sub-let electrical work, setting up his own electrical department instead.

"3. To staff such departments 'raids' are conducted on the shop of electrical contractors, offering higher wage opportunities as bait, and drawing off the electricians. Already this has had the effect of causing one wage increase in a vain effort to hold men, but with generals offering still higher pay, because Uncle Sam pays cost-plus, all this has done has been to make private work cost more. Its effect on the defense program has been to increase the cost of projects to the government, whereas contracts on lump-sum basis would hold defense costs down and speed their completion.

"4. Priorities on electrical materials are beginning to be felt. Without defense work and without materials or men for private work, contractors face business starvation."

Action was taken to request merger of the two associations and steps advanced to secure immediate representation in Washington to present these facts to government agencies and to offer instead a pool of skilled labor and supervisory experience which can be turned into the defense program at a saving to the government both in time and cost.

BC Electric Club

B. Markham, Northern Electric Co., was recently elected president of the Vancouver Electric Club. Howard Walters, manager of the Granville St. store of the B. C. Electric Railway Co., was elected as vice-president and F. Lightfoot, Northern Electric, was elected treasurer with A. J. Napier, Neon Products, as secretary.

Directors of the club are: T. Clarke, district manager Northern Electric Co.; T. H. Crosby, district manager, Canadian Westinghouse Co.; H. S. Dawson, B. C. Electric; W. D. Robertson, district manager Canadian General Electric; G. H. Miller, manufacturers representative; W. G. Metcalf, managing director F. Darling & Co., Ltd.; F. Fatkin, British Columbia manager Royal Cleaner Co. and G. Dickie, mechanical superintendent B. C. Electric Railway Co.

● "LUMINAR" is the name chosen for the bulletin of the Electric Club of Washington to displace the former name, "Bulletin." Originally it was called "RPM." Fred B. Stephen, a Seattle architect, won the $5 prize offered by Norman L. Bost, president of the club.

IES Election

Results of the election for officers of the San Francisco Bay Cities Section, Illuminating Engineering Society, were announced at the meeting July 1, by Chairman Kenneth Knopf of Westinghouse Electric and Mfg. Co. These officers, who take office in September, will be: Walter Carlson, General Electric Lamp Dept., Oakland, chairman; William P. Bear, Pacific Gas and Electric Co., vice chairman; Matthew J. Sisich, Pacific Electrical & Mechanical Co., secretary-treasurer. On the board of managers: Dr. Leland Brown, Stanford University; Robert Dummel, Holophane Co.; Nathan Graves, P G and E, Redwood City; Kenneth Knopf and Gilbert Trosper, P G and E, San Francisco.

Speaker of the meeting was Fred J. Wellhouse, whose talk "Lighting the Skyways and Seadromes" is the first article in this issue. Announcement was made of the resignation of Frank Hansen of Los Angeles as regional vice president.

Hansen Resigns

Because the time required was so great as to seriously affect his own business, and as a health precaution, Frank A. Hansen, director of the Western Institute of Light & Vision, Los Angeles, resigned as vice president of the Illuminating Engineering Society for Pacific region (H).

Hansen devoted virtually all of his efforts for the past half year to develop the IES in the Pacific region and initiated the creation of two new chapters in Seattle and Portland. He also did much to establish the regional program of the Society and created the regional conference, of which there have been two very successful ones in Los Angeles and San Francisco. However, in the regional setup so far developed, no provision had been made for expenses and Hansen also found this a heavy drain on his own personal funds.

No successor has been suggested to the various chapters and sections of the West up to the present time.

Meetings

Rocky Mountain Electrical League convention at Estes Park, Colo., Sept. 11, 12 and 13.

* * *

Electric Club of San Diego, July 1 meeting, Everett Curtis, patent attorney, "Freak Inventions and Unusual Patents."

* * *

Western Merchandise Mart luncheon July 18, Clark Baker, lighting counsellor Northern California Electrical Bureau, talked on "Light and Color in the Home.

PCEA Panorama — Edited by Mary Shoop

Electriquiz

Are these statements true or false?

1. A 3c postage stamp per customer per month would pay the salaries of major executives in most utilities.
2. Electricity has lowered the standard of living.
3. Across-the-line inter-connections exist between utilities serving Oregon, California, Arizona, Nevada and Mexico.
4. The Uniform Electric Code requires all house wiring to be in rigid conduit.
5. A ground-man is called a grunt.
6. California ranks first of all states in the number of electrified farms.
7. Measuring the depth of snow will permit accurate prediction of water supply for hydro-electric plants.
8. A volt is a measure of electrical energy.
9. California electrical rates are established under state control.

Answers on page 80.

Charles L. Palmer, San Joaquin Power Division, PG and E, Fresno, is the author of this interesting quiz.

Appointments

Up in the ranks of the PCEA "army" moves a new group of section and committee "captains" commissioned by "General" G. C. Tenney. To serve until July 1, 1942, they are:

Operating economics section—chairman, H. H. Buell, PG and E, San Jose; vice-chairman, Harry A. Lott, Southern California Edison Co., Los Angeles.

Business development section—chairman E. G. Stahl, PG and E, Fresno; vice-chairman, H. C. Rice, Southern California Edison Co., Los Angeles.

Administrative services section—chairman, S. W. Scarfe, G-E, Los Angeles; vice-chairman, L. C. Rausch, Coast Counties Gas & Electric Co., Santa Cruz.

Highway lighting committee—chairman, A. E. Holloway; chairman, technical sub-committee, G. H. P. Dellmann, both of San Diego Gas & Electric Co.

Women's committee—chairman, Miss Helen Kent, Southern California Edison Co., San Bernardino.

Industry information committee—chairman, H. N. Carroll, PG and E, San Francisco.

Red Seal adequate wiring committee—chairman, G. E. Zelhart, PG and E, Fresno.

Pacific Coast Electrical Bureau committee—chairman, D. E. Harris, G-E Supply Corp., San Francisco.

Code and ordinance committee—chairman, E. F. Watkins, Southern California Edison Co., Los Angeles; vice-chairman, W. F. Neiman, PG and E, San Francisco.

Budget committee—chairman, P. M. Downing, PG and E, San Francisco.

Petroleum electrification committee—chairman, L. S. Peterman, Southern California Edison Co., Los Angeles.

Membership committee—chairman, A. E. Strong, Coast Counties Gas & Electric Co., Santa Cruz; vice-chairman, J. H. Pengilly, Square D Co., Los Angeles.

Publicity committee—chairman, Charles Johnson, Westinghouse Electric & Mfg. Co., San Francisco.

Directors Elect

A glance backward and a glimpse ahead characterized the recent meeting of the PCEA board of directors in San Francisco, at which retiring President C. E. Houston reviewed outstanding achievements of the past year, and incoming President G. C. Tenney outlined energetic plans for another successful term. The meeting was the annual combined session of newly elected and retiring directors.

Election of officers for this year brought the unanimous selection of J. O. Case, Quality Electric Co., Ltd., Los Angeles, and H. H. Courtright, Valley Electrical Supply Co., Fresno, for vice-presidents. N. R. Sutherland, PG and E, San Francisco, was re-elected treasurer.

The vacancy on the board created by Tenney's election to the presidency was filled by the election of A. D. Brown, Allis-Chalmers Mfg. Co., Los Angeles.

One Conclave Only

Beginning this fall, one PCEA conclave will be held at a central location in California instead of one in the northern part of the state and one in the south, as has been the practice in the past. This change, designed to further a broader viewpoint and wider exchange of ideas on matters discussed at the conclaves, was authorized by the board of directors at the suggestion of all three PCEA sections.

A separate conclave for the operating economics section, to be held at a different time than the business devel-

Who Am I?

I was born in Watsonville, Calif., Dec. 14, 1887, attending school there and in Salinas. After several years of study and experience in the electrical business in San Francisco, I went to Fresno where I organized the Modern Electric Light and Fixture Co. In 1912 I became manager of the lighting fixture department of the newly organized Valley Electrical Supply Co., as the retail store of the San Joaquin Light and Power Corp. was known at that time. In 1916 I was made vice-president and manager. I am now its president and manager, and the company has attained a leading position in electrical construction circles in the San Joaquin Valley. Who am I?

In 1921 I presented a new plan of merchandising appliances to the electrical industry. Known as "Through the Dealer Plan," it received national recognition as a dealer cooperation plan benefitting both the seller and the consumer. For its development I received the James H. McGraw Award in 1928, and the treatise on which the award was made is now a part of the utility merchandising course at the Harvard School of Business. Who am I?

I am a vice-president of the Pacific Coast Electrical Association and a director of the Northern California Electrical Bureau. In the past I have been a member of the board of directors of the California Electrical Dealers, Pacific Coast Electrical Bureau and the Society of Electrical Development. I am affiliated with B.P.O.E., Masonic Lodge, Knights Templar, Scottish Rite and Shrine, as well as Rotary, Commercial Club, University-Sequoia Club and the Sunnyside Country Club. I am married and have one daughter, and my name is: See page 80.

= $1000

That's the recovery of lost revenue on a typical feeder with the narrower band width held by G-E induction regulators*

Ease and Accuracy of Voltmeter Setting

With the G-E contact-making voltmeter, adjustments for voltage level, band width, and holding effect are completely independent of one another. Furthermore, the value to which any of these is set is not affected by changes in the settings of the other two.

The voltmeter can be set for the desired values readily, without the use of tools.

It is a precision instrument, and once the settings are made, it can be relied upon to hold band width *accurately*.

Evidence of the accuracy of the G-E voltmeter is to be found in its practically flat temperature-accuracy and frequency-accuracy curves, made possible by a special capacitor-reactor ballast.

RECENT tests show that G-E induction voltage regulators hold a 2-volt effective band width, not a 4-volt band width as provided by feeder voltage regulators of other types. This narrower band width means that average voltage can be increased by one volt or more, all along the line, and the minimum voltage raised by 2 volts or more, without exceeding the permissible maximum at the first customer. The result is a recovery of lost revenue amounting to $1000 annually on a typical feeder.

Or, if feeder conditions make it desirable, the advantage of narrower band width can be used to extend your present feeders without increasing the voltage difference between the first and last transformer. In other cases, the advantage can be used to increase load-carrying capacity.

These operating advantages provided by the G-E induction regulator really represent an extra dividend on your investment in regulation. Ask your G-E representative to show you just how much the 2-volt band width held by G-E induction regulators can mean to you in reduced revenue losses, additional feeder length, or increased load capacity. General Electric Company, Schenectady, N. Y.

★For Engineers Who Like to Do Their Own Figuring:
This typical example is based on a reduction of 2 volts in band width on a uniformly loaded 3-phase 225-amp, 4-kv feeder having a 40% yearly load factor and 90% average power-factor; power valued at 3¢ per kw-hr; only the lighting load (50% of total) is affected by voltage changes; power consumed varies as (volts).1.6

GENERAL ELECTRIC

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opment and administrative services section conclave, will be another departure from custom. This move was made at the request of the operating economics section to enable its members to devote their entire program, including general assemblies, to technical discussions of operating matters.

The dates and location of the fall conclave will be announced soon. The selection is being made by the guidance committees of the three sections.

District Meetings

Emulating the well known episode of the mountain going to Mahomet, PCEA will take its activities again this fall to members whose residence some distance from convention and conclave sites prevents them from attending these official gatherings. This year's district meetings will be held Sept. 29 to Oct. 17 in 15 cities, 14 in California and one in Reno, Nev. Last year's schedule will be followed in general, and each meeting will draw attendance from a large surrounding area.

A question and answer round table presided over by a panel of outstanding industry men will feature the timely and interesting program. All PCEA members who expect to attend the meeting are requested to send in their questions before Sept. 1, and they will be answered by a member of the discussion panel. Questions may be sent to the Pacific Coast Electrical Assn., 447 Sutter St., San Francisco, or 601 W. 5th St., Los Angeles.

The industry information committee is in charge of the district meetings, which are in their fifth consecutive year. Las year the combined attendance was 2,760.

EMEA

"Fluorescent Trouble Shooting," the lecture demonstration by Walter C. Heston, acting manager, Northern California Electric Bureau (which appears in this issue, page 56) will be given to the Electrical Maintenance Engineers Assn. of Northern California in September. Previous meeting was presented the talk "Lighting in England's Blackout" by W. A. Cyr, Associate Editor, ELECTRICAL WEST, which had previously been given to the IES.

At the recent election of officers for the Electrical Maintenance Engineers, Warren James of the Alaska Commercial Building, was elected president to succeed H. W. Goldsmith, Adam Grant Bldg., Joseph O. Engler, assistant engineer at 111 Sutter St. Bldg., was named vice president and L. A. Jacobson of Norris Beggs and Simpson, secretary-treasurer. Election of members of the executive committee was postponed until later.

● X-RAYS and their characteristics were brought before the Electrical Maintenance Engineers Assn. of Southern California at its July 15 meeting by W. J. Cox, manager General Electric X-ray Corp. in Los Angeles. The G-E picture "Exploring with X-ray" was shown first to lay the background and discussion followed on the various industrial uses of X-rays and the safeguarding of its use and of operators. Glenn Farr, president, had charge of the meeting.

EMEA *Dope Sheet* — *Edited by Howard C. Park*

EMEA of So. Calif.

(Continuing "What an EME Should Know" About—)

Distribution System

The distribution wiring system consists of: main panelboard, feeders, feeder distribution centers, sub-feeders, sub-distribution centers, and branch circuits.

While the method of distribution used may vary, from open wiring to rigid conduit or busway installation, the fundamental principles for adequate current carrying capacity and flexibility of the system remain the same.

The service rendered by the system may be divided into three general classes:

Power for heating, motors and welding equipment.
Energy for lighting.
Services for low-tension equipment (communications, alarm systems, etc.).

Distribution Feeders

The following should be known of each distribution circuit:

Actual secondary supply voltage.
Type and capacity of feeder switch.
What is capacity and setting of circuit protective device?
What is total connected load?
What is demand load?
Power factor of circuit.
Insulation resistance (megger test).
Length of circuit (one way).
Voltage drop of circuit.
Size and current carrying capacity of conductors.
Drawing of the circuit, including wire and conduit size and length.

Feeder Distribution Centers

The same information should be had of each distribution center equipment as for main switch board equipment.

Are distribution centers located at load-centers?

Sub-Feeders and Branch Circuits

The same information should be had for each sub-feeder and branch circuit as for each feeder circuit, including circuit length (one way). What is total voltage drop from switch board to current consuming equipment.

Lighting

Since lighting efficiencies are more critical to voltage variations than most other power requirements, the power is usually supplied by transformers and feeders separate from other circuits.

What is voltage at load center of each light circuit?
Is each circuit clearly and correctly marked at each distribution panel?
Are switches conveniently located?
Do lamp voltage ratings compare to circuit voltage?
Are light sources subjected to excessive vibration?
Are light fixtures cleaned regularly?

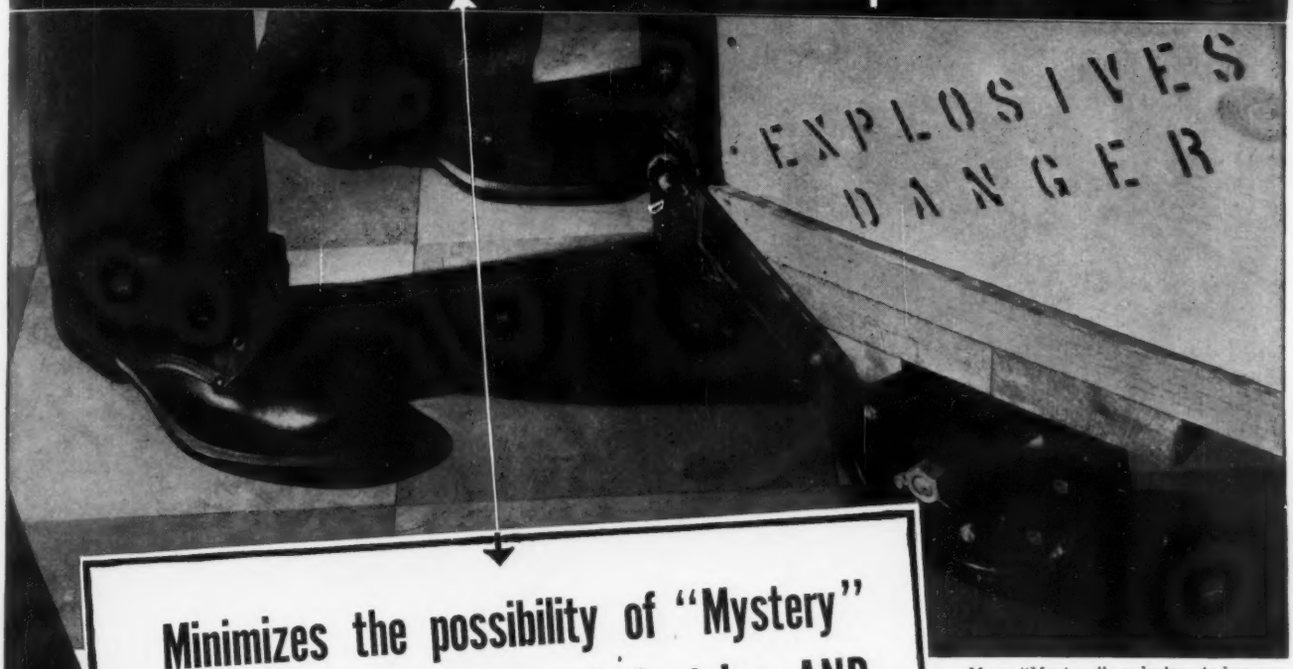
The function of lighting not only is to provide visibility but also to *aid the ease of seeing*. Consequently, the type of fixtures, spacing and location of fixtures, and the size of light sources which will provide proper illumination quality and intensity is very important.

Motors

A master list of all motors in service, showing type, size, rpm., and style of bearings should be compiled. A list of all spare motors showing size etc., should be compiled. The following data of each motor and its connected equipment should be known:

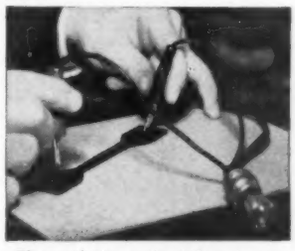
Name-plate data of motor.
Is motor of proper type and size for operation?
Purpose or operation for which motor is used.
Type and catalog number of bearings used.
Kind and frequency of lubrication.
Shaft and key-way sizes.
Motor pulley, sprocket or gear size and type.
Coupling type and catalog number.
Quantity, type, and catalog number of brushes (if used).
Size and catalog number of capacitor (if used).
Surrounding air conditions of motor (dust, fumes, temp., moisture, etc.).
Motor amperage and hp. (full load).
Motor amperage (with no load).
Motor starting amperage (with load).
Accelerating time.
Motor operation temperature.
Insulation resistance of motor.
Kind or type of speed reduction equipment used.
Length and catalog number of belt or chain used.
Take off rpm. of reduction drive.
Type of motor base (rigid, adjustable, etc.).

CONDUCTING RUBBER makes it possible . . .

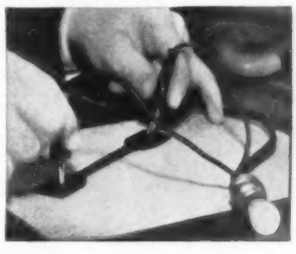


Minimizes the possibility of "Mystery" explosions in defense industries AND eliminates the deteriorating influences that attack insulation in POWER CABLES

Many "Mystery" explosions today, can possibly be explained by the fact that a worker scuffing across a non-conductive floor can build up a sufficient charge of static electricity to make a good hot spark. In realization of this, the War Department instigated the development of "conductive occupational" footwear—now on the feet of thousands of workers in defense industries.



These photographs taken in our laboratories show a 15-watt bulb being lighted by the flow of current from a 110-volt plug-in, through an ordinary "dumb-bell" sample of conducting rubber. These tests indicate that wide range of conductivity in rubber is available, and this conductivity can be varied to suit the best design of cable.



American Steel & Wire Company's Type PS Semi-Conducting Shielding (Conducting Rubber) makes any insulation "Corona Proof"—and since no ozone forms, there is no need for further protection against ozone action!

FOR over 40 years, manufacturers of insulated cables have concentrated on producing "ozone-proof insulation". While many types have been put on the market that controlled corona and attendant ozone formation to varying degrees — *cables still did develop trouble.*

But now American Steel & Wire Company has developed a *New* shielding! A truly significant discovery — TYPE PS SEMI-CONDUCTING SHIELDING (Conducting Rubber)—that completely eliminates these previously non-controllable, highly deteriorating influences which attack organic insulation. Type PS Semi-Conducting Shielding is produced by an exclusive American Steel & Wire Company process. Power cable users will instantly recognize its great value.

At the present, we can supply users with many types of single and multiple conductor cables, sheathed by various methods with Type PS Semi-Conducting Shielding. Write today for more complete information and our technical brochure — all requests will be promptly handled.

COLUMBIA STEEL COMPANY, *San Francisco, Pacific Coast Distributors of U·S·S Electrical Cords and Cables*

Manufactured by

AMERICAN STEEL & WIRE COMPANY, *Cleveland, Chicago and New York*

United States Steel Export Company, New York

UNITED STATES STEEL

ONLY WATTHOURS *Metered*...

AUTOMATIC IRON LOADS ARE PAYLOADS

WHEN METERED WITH . . .

ADEQUATE WIRING SERVES ... SAVES

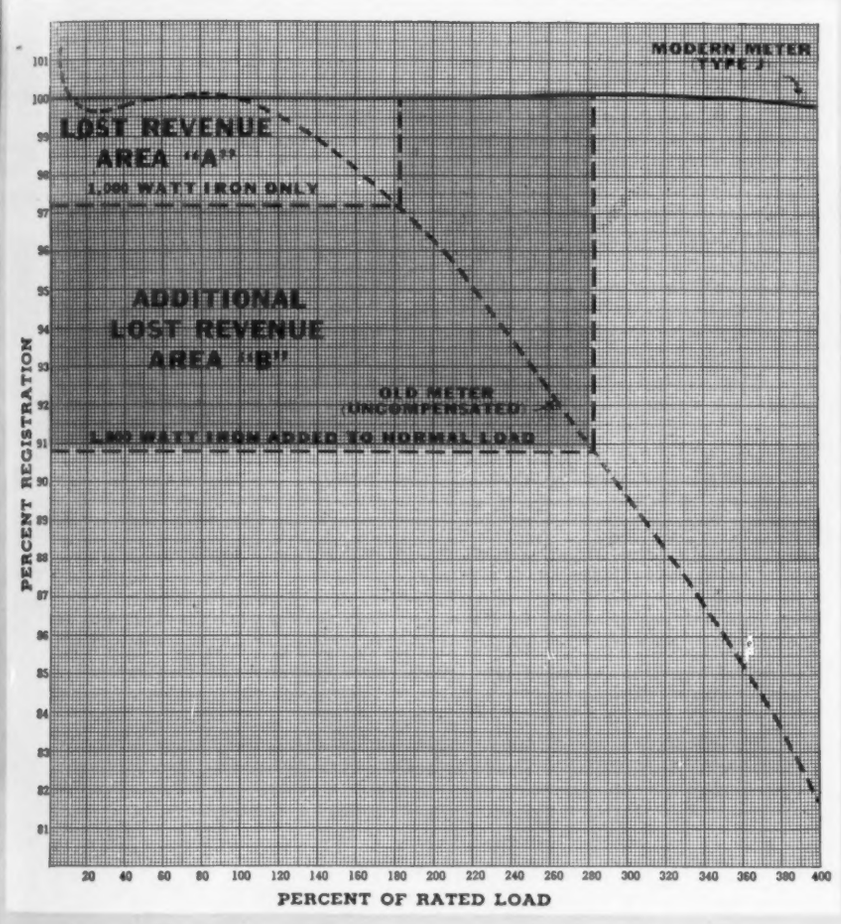
This New
MANNING-BOWMAN AUTOMATIC IRON
Has a Tangleproof Cord and These Other
GREAT IMPROVEMENTS
WAGS-ITS-TAIL . . .
UNIVERSAL
12,000,000 meters now in service are old and uncompensated, with load characteristics comparable to those indicated by the drooping curve. Considerable revenue losses often result from metering modern applic nce loads with these uncompensated meters.
THE FASTEST, FINEST IRON EVER MADE
Heats Quicker . . Stays Hotter . . Irons Faster
Sunbeam
DOUBLE-AUTOMATIC
IRONMASTER
American Beauty ADJUSTABLE-AUTOMATIC
ELECTRIC IRON • THERMOSCOPIC TYPE
You Have:
Under Your Eye
At Your Fingers

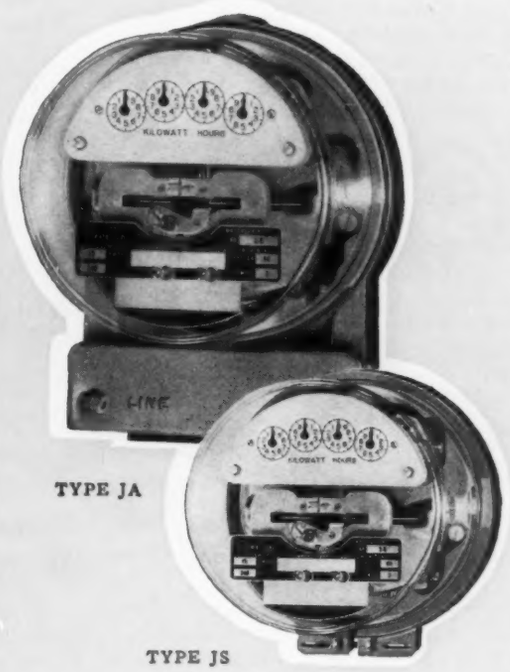
SANGAMO ELECTRIC

PRINT IN BINDING

...ADD REVENUE Dollars!

...Modern Meters





TYPE JA

TYPE JS

Available in either "A" or "S" mountings, Type J Meters are designed for indoor and outdoor service. Ability to measure accurately loads ranging from a small percentage to 400 percent of the meter's normal full load rating, is an inherent characteristic of the Type J Meter.

EFFECTIVE advertising and selling has made electric irons America's No. 1 home appliance. The greater wattage of modern automatic irons, and the contemplated introduction of electrically heated ironing tables, both promise a continued upswing in the load curve, with added revenue from these sources.

Only the accurate measurement of these loads, as provided by modern watthour meters, assures full revenue now, as well as in the future. But with an old, uncompensated meter, the load from a 1000 watt iron can cause a registration loss of 2.8 percent, (see "Lost Revenue Area A"). Added to other normal loads, the loss may be as great as 9 percent, (see "Additional Lost Revenue Area B").

An adequate survey of individual operating properties will indicate where a change to modern meters will be a profitable investment through revenue gains.

COMPANY SPRINGFIELD ILLINOIS

NEWS of the industry

PG AND E REVISES POWER PROGRAM

Confronted with possible conflicts of jurisdiction between federal and state agencies, Pacific Gas and Electric Co. early last month decided to forego construction of plants at Pulga and Cresta on the Feather River and substituted therefor approximately the same amount of hydroelectric capacity on the Pit River. Simultaneously plans were announced for the construction of a 75,000-kw. steam plant at Midway in the San Joaquin Valley.

Decision to reject the license for the Feather River plants recently issued by the FPC was due to stringent conditions imposed by the commission, which the company believed "would raise intolerable conflicts in jurisdiction between federal and state agencies." The company's official statement said that "efforts to obtain a modification of the decision had been unsuccessful and the company has advised the commission that it will be impossible to accept a federal license under the conditions imposed. The conditions are unusual and would make it impossible for the company to construct additional generating facilities, either steam or hydro, or to contract for additional power, with minor exceptions, without approval of the Federal Power Commission, irrespective of whether such additions are subject to regulation under the Federal Water Power Act. Under the California Public Utility Act the company is required to provide all facilities reasonably necessary to serve the public, regardless of whether or not any public body directs the construction of additional facilities."

Equipment that had been ordered for the Feather River plants will be transferred to the Pit River project. The hydro program on that stream calls for the installation of four 40,000-kw. units in the Pit No. 5 or Big Bend plant. Two other undeveloped sites remain on that stream—Pit No. 2, 15,400 kw. and Pit No. 4, 46,500 kw.

On receipt of notification of the change in PG and E plans, the FPC issued a notification that a formal declaration of intention would be required from the company and that if, upon investigation, it was found that the proposed Pit River plant affected the interest of foreign or interstate commerce, the filing of an application for license under provisions of the federal Water Power Act would be incumbent on the company.

The additional steam capacity at Midway on the southern end of the PG and E system has been under consideration for some time. It was deferred pending the expiration of a power purchase agreement with Southern California Edison Co., but has been re-instated to insure adequate defense power.

As scheduled at present PG and E's $60,000,000 expansion program calls for the following additions to capacity:

Oleum first 44,000-kw. steam unit.....August, 1940
Piedra Interconnection with So. Cal. Ed. 75,000 kw...January, 1942
Pit No. 1 and Hat Creek storage 38,000 kw. peaking capacity.....July, 1942
Dutch Flat, 21,000 kw...August, 1942
Upper Narrows, 9,000 kw.....December, 1942
Pit No. 5, 75,000 kw.....July, 1943
Oleum second 44,000-kw. unit.....July, 1943
Midway, 75,000 kw...December, 1943

Completion of these plants will give PG and E a dry-year system capability as of January 1, 1944 of 1,775,000 kw.

Northwest Gets Four New Electro-metallurgical Plants

Four new electro-metallurgical defense industries will receive power from the Bonneville-Coulee transmission network according to Bonneville Administrator Raver. They include three aluminum plants and one magnesium enterprise to be located at Spokane, Cascade Locks and Tacoma.

All will be built by the government under the sponsorship of OPM and the War Department and will be leased to private organizations for operation. Largest installation will be a 100,000,000-lb. aluminum reduction plant at Cascade Locks to be operated by Alcoa. It will require 97,000 kw. Union Carbide and Carbon Co. will operate a 60,000,000-lb., 65,000-kw. aluminum plant at Spokane and the Olin Corp. a 30,000,000-lb. 32,500-kw. plant at Tacoma. The magnesium production unit will be a 24,000,000-lb. installation using 35,000 kw. to be operated by the Chemical Division of the Todd Shipbuilding Co. at Spokane.

● CONSTRUCTION of a plant at Los Angeles for the manufacture of copper products is provided for in an agreement just completed between the Phelps Dodge Copper Products Corp. and the Defense Plant Corp. Plant and equipment will cost $2,995,000.

McKEE SAYS TIE-LINES WOULD SAVE 100,000 KW

Interconnection of facilities and pooling of power resources in the Pacific Northwest would add 100,000 kw. to the region's power production capacity according to Paul B. McKee, president of Pacific Power & Light Co. The statement was made in connection with an announcement of plans for four additional tie-lines between PP&L and Northwestern Electric that would make possible the interchange of energy with Bonneville at strategic points.

Conservation of energy in this manner would mean the conservation of money and materials, McKee contended in stating that all that was needed to put such a cooperative plan into effect was word from Washington, D. C., that cooperation was in order. That much capacity in new plant facilities would cost $10,000,000 to $20,000,000, he declared, and would require two years to build.

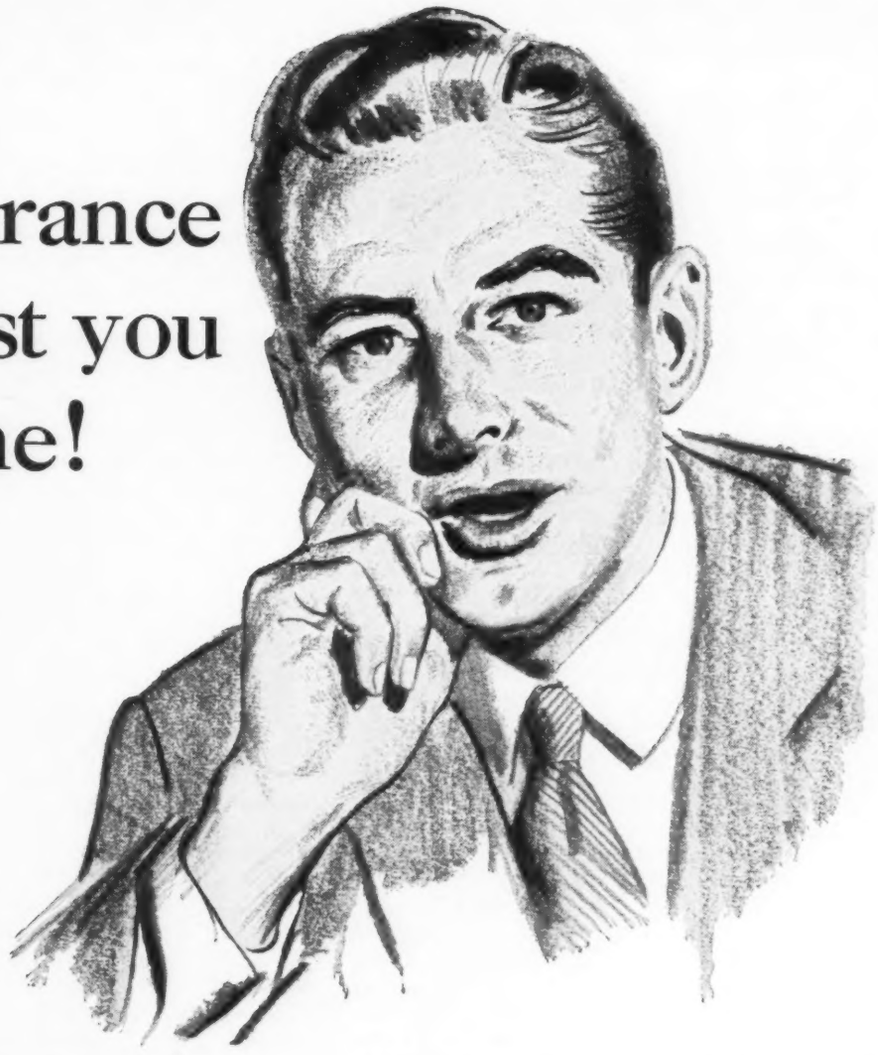
Interconnecting lines under study by the two companies would be available for interchange of power between Northwestern and Bonneville at Portland and between PP&L and Bonneville at Walla Walla, Hanford and Union Gap. They would range from a minimum of a mile of 66-kv. line in the first case to eight miles of 110-kv. line.

PUD Challenges Bremerton Municipal Power Plans

The State Supreme Court will be asked to rule on a Superior Court ruling that Bremerton, Wash., has a right to establish its own municipal power system by virtue of a 12-year old Bremerton ordinance, when the Kitsap County Public Utility District makes its appeal shortly. Creation of a separate Bremerton municipal power area, it is admitted on all sides, would handicap seriously the successful operation of a county-wide PUD exclusive of Bremerton, for the maintenance of a rural district unsupported by municipal revenues would be too expensive. Rapid extension and development of the Puget Sound Naval Yard at Bremerton, with the accompanying growth in population, also complicates the situation.

● OPERATION of the first 108,000-kw. Grand Coulee unit originally scheduled for August 1 by USBR engineers will be postponed until after the middle of the month because of equipment delays.

My insurance won't cost you a dime!



YOU DON'T believe *I* sell *insurance?* Then you and I have never talked about Shell's Safety Factors!

Literally, what these Safety Factors do is protect a plant like yours against unnecessary shutdowns . . . against fuel waste . . . and too big an outlay for lubricants.

And you get this kind of insurance free whenever you buy a Shell lubricant!

How come Shell can give you such insurance? It's because 821 scientists and their helpers at the "University of Petroleum" (Shell's $3,500,000 research laboratories) are forever looking for and finding new ways to reduce your operation hazards and expense.

Next time I'm by your place, how about asking me for the full story on our *free insurance?*

Your Shell Salesman

SHELL'S SAFETY FACTORS PROVIDE

- Better control of friction heat
- Better control of combustion heat
- Slower rates of wear
- Increased power off-take
- Savings on shutdown losses
- Reduced outlay for lubricants

BONNEVILLE CONSTRUCTION TOTALS $22,858,500

Construction of two new substations, extensions to four others and two new 115-kv. transmission lines costing $7,200,000 in the aggregate have been approved by the Bonneville Power Administration. This is the second group of projects announced as part of the $22,858,500 program for fiscal 1942.

Previous allocations from new appropriations included $3,863,130 for a second 230-kv. Bonneville-Coulee line; $1,602,700 for a double circuit 115-kv. line between Bonneville and Vancouver and $140,000 for a 230-kv. steel tower crossing at Bradford Island.

Largest single new construction job approved will be a major substation, near Covington, Wash., involving expenditure of $2,211,950. The substation, western terminus of the 230-kv. Covington-Coulee line now under construction, will serve communities in the Puget Sound area. Additions to the North Vancouver, Wash., substation, which serves the Portland and Lower Columbia river areas, will cost $2,094,370.

Allocation of $500,000 for initial construction has been made for the Longview substation, which will serve the Longview industrial area and the Cowlitz County Public Utility District distribution system. The allocation also covers construction of a temporary substation to serve the Reynolds Metals Co.

The Midway substation, relay point for central and eastern Washington, and eastern Oregon areas, will be enlarged to stabilize load conditions and provide facilities for satisfactory transmission of the tremendous increase in output from Grand Coulee dam this August. Cost of the work will be about $792,000.

Proposed additions to the North Bonneville substation, involving expenditure of $540,000, will permit complete energization of all lines radiating from the station. Increased load demands in the Portland, Vancouver and lower Columbia river areas have necessitated allocation of $290,330 for additions to the St. Johns substation.

The Rainier-Longview, 115-kv. line has been approved for $252,150. This circuit will carry power from a tap on the St. Johns-Astoria line, across the Columbia river to the Longview substation. The Pendleton-La Grande, 115-kv. line has been approved for $574,090. The 49-mile wood pole line will provide service to the Union County Public Utility District.

● EXTENSION of a line to double the electric energy now being used by the Ohio Ferro Alloys Corporation plant in Tacoma, Wash., will be rushed by the City Light Department, according to utilities commissioner R. E. O'Neil. He also introduced an ordinance to authorize purchase of four 3333 kva 50/8 kv transformers and an appropriation of $30,000.

Alcoa Expands Southern Calif. Manufacturing Facilities

In 1937, to serve the expanding airplane industry of Southern California, the Aluminum Company of America bought 15 acres of land in Vernon, Los Angeles County, constructed a sand and permanent-mold foundry and forge plant. This works was completed early in 1938, and at the start of the war the Vernon plant had a capacity of 100,000 lbs. of aluminum alloy forgings, and 424,000 lbs. of sand and permanent-mold castings a month.

In the spring of 1940, facilities were expanded and included the addition of an extrusion works and rivet plant, as well as additions and improvements to the existing aluminum foundry and forge plant. Site of this expansion program was an additional 30 acres of adjacent land.

Buildings necessary to house new fabricating facilities are now completed, and equipment is rapidly being installed to handle increased production, and according to Alcoa, sand and permanent-mold casting capacity will have been increased to 593,000 lbs. a month (an increase of 40%), and the forging capacity to 450,000 lbs. a month (an increase of 350%); while the new extrusion plant will turn out extruded shapes at the rate of 1,019,000 lbs. a month. By March, 1942, it is estimated that forging capacity of the Vernon works will be increased an additional 50,000 lbs. a month. In terms of floor space, the works has been expanded from 100,000 sq. ft. at the start of the war to 555,000 sq. ft. (an increase of 455%).

Aluminum Company of America has increased its southern California manufacturing facilities 455% in order to meet demands of the aviation industry for aluminum products. Since the start of defense production the Vernon plant has expended to the size shown in the picture at the right. Castings, forgings rivets and extruded products comprise the items manufactured here.

AIEE MEETS AUG. 27-29 AT YELLOWSTONE PARK

Yellowstone National Park, mecca of vacationists from all parts of the United States, has been chosen the setting for the Pacific Coast convention of the AIEE, August 27-29—offering attendees the double lure of a splendid holiday and a sound technical program. Headquarters for registrants will be the Canyon Hotel, near the Great Falls of Yellowstone, and the tentative program calls for four sessions here on: protective devices, basic sciences, power generation, transmission,—distribution and other selected subjects. One session will deal particularly with latest scientific developments and communication progress.

The general committee for the 1941 convention includes: W. H. Reif, chairman; H. E. Murdock, vice-chairman; E. W. Schilling, secretary-treasurer; J. W. Barker, W. L. Bryant, Jr., C. V. Fowler, J. M. Gaylord, O. C. Haycock, H. W. Hitchcock, H. B. Hodgins, J. A. Hooper, G. R. Shuck, J. H. Steede and A. L. Taylor.

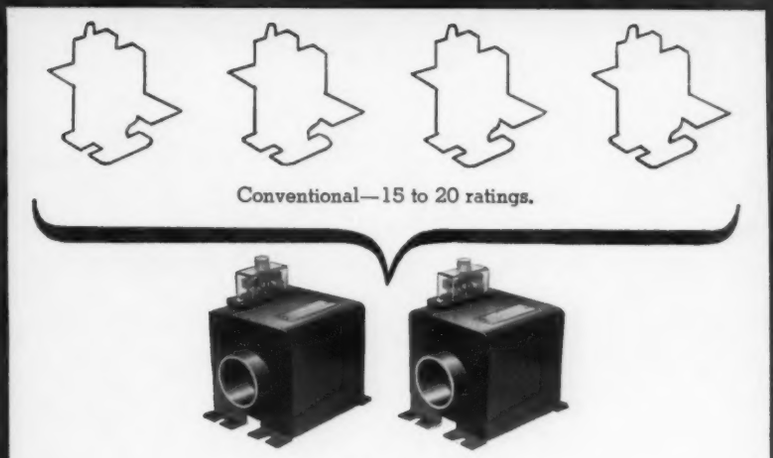
Vacation-minded members are offered a tour through the tremendous copper mines of Butte, Montana; a trip through the famous Morrison Cave, third largest in the U. S., and for motoring members Glacier Park, Grand Teton, Fort Peck Dam, rodeos, mines and historical spots offer wanderings as extensive as time and enjoyment dictate.

● THE CITY of Bremerton, Wash., has received a request from the Bonneville Administration for a franchise to erect a power transmission line within the city. The government agency also requested a temporary permit, so that construction of the power line may not be delayed in any way. Bremerton is the home of the Puget Sound Naval Yard, and scene of vast government activity.

two- INSTEAD OF twenty

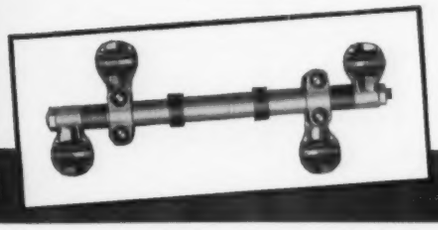
STOCK ONLY 2 RATINGS

FOR FULL RANGE METERING ACCURACY UP TO 1200 AMPERES



Conventional—15 to 20 ratings.

Type FW—only 2 ratings.



Special connector for changing ratio or for making the FW a two-wire or three-wire unit.

WITH THE WESTINGHOUSE TYPE FW CURRENT TRANSFORMERS

Using Hipernik instead of silicon steel for the core has so widened the range of this FW Current Transformer that two units will cover the applications that used to require twenty different sizes.

THIS *UNIVERSAL* TRANSFORMER not only costs less to buy and to install, but also eliminates the cost of frequent transformer changes to accommodate varying loads.

Accuracy at 300% current is fully maintained. The FW can be operated at 200% normal current continuously without exceeding 55 degrees C. temperature rise with 40 degrees C. ambient.

TESTED INSULATION STRENGTH, confirmed by passage of 10,000 volts with bare conductor, permits use on circuit voltages above 1000 volts with insulated conductor.

INSTALLATION IS SIMPLE because the FW can be mounted in any position. Its lightness and small dimensions permit neat, compact meter boxes. Wiring is simplified by the through-type design. The secondary terminal block is fitted with cupaloy solderless connectors for added strength. The secondary terminal block is provided with a short circuiting device.

Both ratings are carried in stock.

For additional information ask for F-8583. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Department 7-N.

J-70337

Westinghouse TRANSFORMERS

INCREASING LINE VOLTAGES DOESN'T NEED TO BE EXPENSIVE

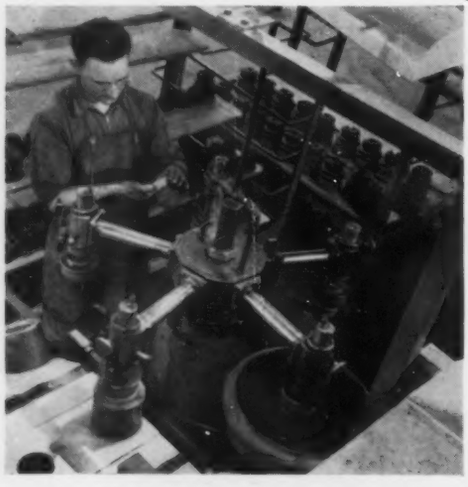
AN EXAMPLE OF HOW A LINE WAS REBUILT TO CARRY HIGHER VOLTAGES, NOISELESSLY, AND AT A MINIMUM OF EXPENSE WITH R.I.P. PIN TYPE INSULATORS

Yesterday

A 33 kv single circuit line, built originally under closely designed clearances, was equipped with suspension type insulators. Problem: to raise the line voltage to 66 kv. Using suspension insulators, this meant new poles and new crossarms to secure necessary clearances—an expensive operation.

Today

With Westinghouse R.I.P. pin type insulators, the changeover is much less expensive. The same poles are used and the necessary ground clearance gained by raising the crossarm. The third phase is placed on a pole top pin. R.I.P. eliminates the possibility of insulator-generated radio interference.



PRECISION R.I.P. GLAZING

Only Westinghouse gives you this automatic R.I.P. glazing . . . an extra precaution to insure uniformity of the radio-interference-proof coating on every insulator. The machine arm dips an accurately controlled area of each insulator into the vat of metallic oxide glaze . . . always just the right amount. No chance of human error. Another "extra" you pay no more for when you specify Westinghouse Porcelain!

R. I. P.
High Voltage Pin Types

For Low-Cost, Noiseless Transmission Lines Up To 66 Kv.

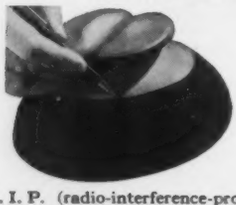
To transmission line engineers faced with new line construction . . . or increasing voltages on existing lines . . . R.I.P. high voltage pin type insulators offer important savings.

On new single circuit lines, pin type insulators require less pole height—only *one* and *smaller* crossarm. Third phase goes on pole top pin. Result—lower pole cost . . . less labor . . . less hardware. For raising present line voltages, pin types do away with need for new and taller poles or new crossarms. Just take down present insulators and install the new ones.

R.I.P. pin type insulators eliminate the objectionable radio noise formerly inherent with pin type construction . . . make available lower construction costs . . . provide rapidity of changeover. Why not take advantage of them? Two modern factories—Derry, Pa., and Emeryville, Cal. Westinghouse Electric & Mfg. Company, E. Pittsburgh, Pa., Dept. 7-N.

J-05123

R.I.P. Glaze Permanently Eliminates Insulator-Generated Noise



R. I. P. (radio-interference-proof) treatment applied to insulator surfaces is guaranteed by Westinghouse to eliminate insulator-generated radio interference. The metallic oxide glaze becomes an integral part of the insulator during the normal firing process. It never wears off—never needs servicing.

NOISY—Capacity currents jump across the tiny air gaps between conductor and insulator surfaces. These capacity arcs act as miniature radio stations. Result—radio interference.

QUIET—Metallic (R.I.P.) glaze furnishes a lower resistance contact. Result—capacity currents flow through contacts, *but not across air gaps.* No arcs . . . no radio interference.

Westinghouse Porcelain

Krug of TVA Replaces Kellogg of EEI on OPM

J. A. Krug, power manager for TVA, has replaced C. W. Kellogg, president of Edison Electric Institute, as power consultant for OPM. Mr. Kellogg resigned in compliance with a new, and unannounced, policy adopted by OPM making trade association officials ineligible for employment as members of the defense agency. Only one or two other OPM executives were affected by the policy.

Mr. Krug was headed for OPM even before Mr. Kellogg resigned. He was to have been "loaned" to the agency to find means of pooling enough power quickly to provide for needed aluminum and magnesium production capacity.

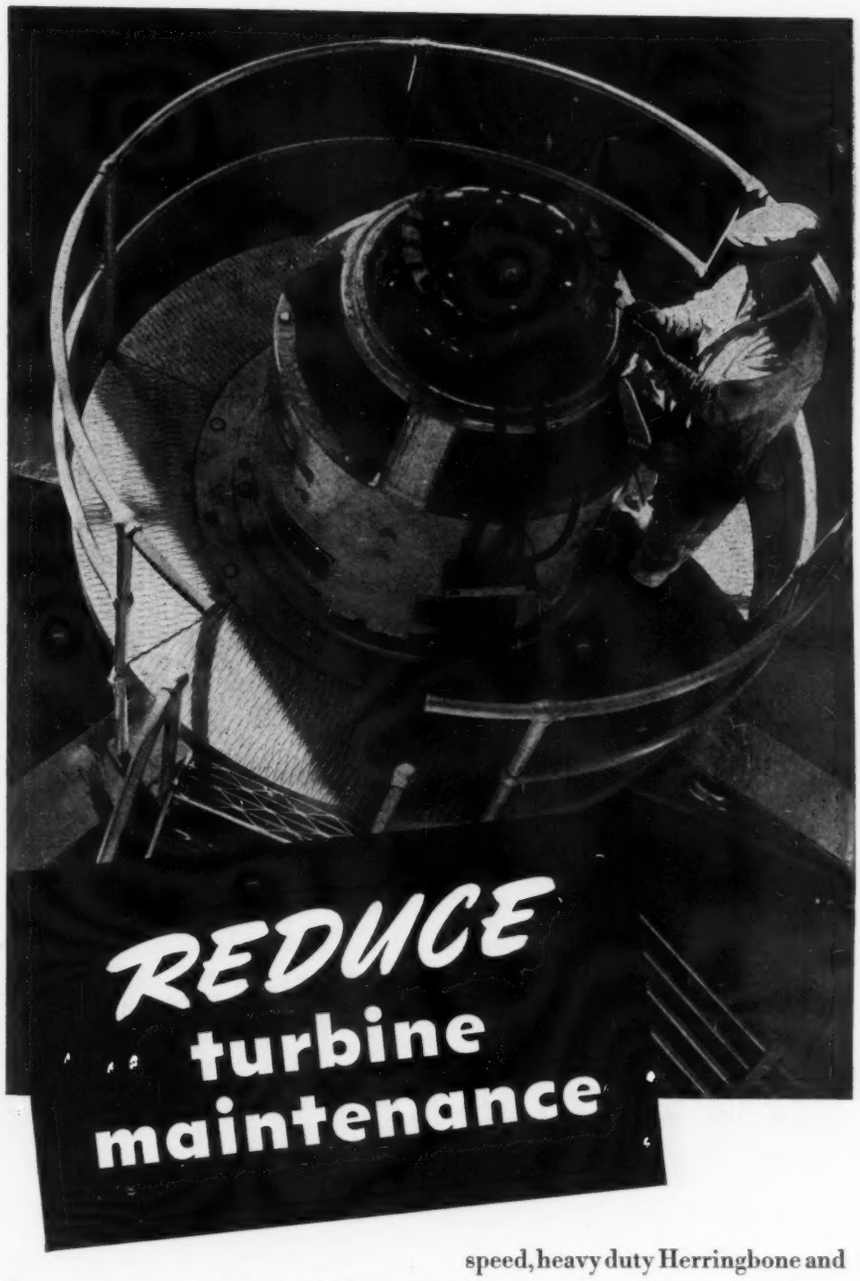
With the EEI president's departure, Mr. Krug was given a full appointment to OPM's staff and it is understood that he may be selected by the President as national power "co-ordinator"—an obvious middle-ground step between Secretary Ickes, who is campaigning for the post, and FPC Chairman Leland Olds.

Report Says PG and E Not North American Subsidiary

Recommendations that the SEC should find that the Pacific Gas and Electric Co. is not a subsidiary of the North American Co. were contained in a report filed by a trail examiner coincidental with the taking of arguments before the commission in Washington.

Consideration of testimony and evidence developed at hearings in San Francisco some time ago lead the examiner to recommend to the SEC that it find that (1) North American does not have power to control PG and E; (2) PG and E has never been and is not now controlled by North American; (3) PG and E is now and has been since 1912 predominantly an intrastate California utility; (4) all assets are located in that state and the company does not buy or sell electricity outside; and (5) exemption of PG and E from the provision of Title 1 of the Holding Company Act would not be detrimental to public interest.

● U. S. RECLAMATION BUREAU is checking the possibility of constructing a dam and power plant to provide an immediate power development in southern Utah. The site under consideration is that in Dark Canyon, Juan County at which a plant having a capacity of 200,000 hp would be located in expectation of future industrial employment.



UNACAL TURBINE OILS can help you minimize emulsification, oxidation, sludge and foaming—the four most common causes of lubrication trouble. They are carefully blended and refined to give top protection, to reduce maintenance to a minimum.

Unacal Turbine Oils are available in any of four grades to suit your turbine, whether steam or water-operated, direct-connected or geared. Extra heavy grades are available for high speed, heavy duty Herringbone and Helical Reduction Gears and Kingsbury Thrust Bearings.

Your nearest Union Oil representative will be glad to give you further details. Why not call him today.

UNION OIL COMPANY

UNACAL
TURBINE OILS

System	Plant and Location	Capacity Kw.	Year
Utah Power & Light Co.	Jordan Plant, Salt Lake City, Utah	25,000	1943
		25,000	1944
	Provo Station, Provo, Utah	50,000	1945
The Mountain States Power Co.	Coos Bay Plant, North Bend, Ore.	30,000	1944
		30,000	1946
Portland General Electric Co.	"L" Station, Portland, Ore.	35,000	1945
		35,000	1945
Puget Sound Power & Light Co.	Shuffleton Plant, Renton, Wash.	35,000	1945
		35,000	1945
Seattle Municipality	Lake Union Plant, Seattle, Wash.	25,000	1945
San Diego Gas & Electric Co.	Silver Gate, San Diego, Calif.	35,000	1944
		35,000	1944
Central Valley Authority	Antioch — Antioch, Calif.	75,000	1945
Los Angeles Bureau of Power & Light	Harbor Plant, Los Angeles, Calif.	65,000	1945

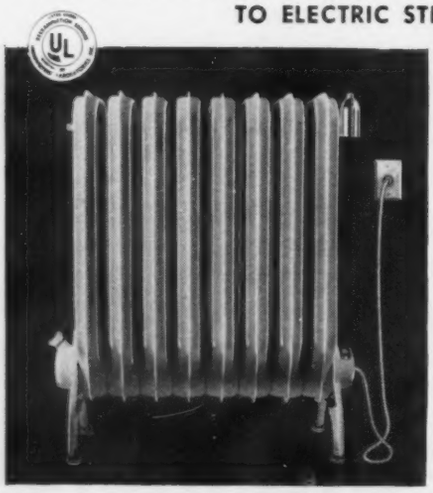
Drainage Basin	Project	State	Capacity Kw.	Year
Columbia River	Grand Coulee[1]	Wash.	324,000	1943
			108,000	1944
			108,000	1945
			108,000	1946
Puget Sound	Nisqually	Wash.	90,000	1944
Fayette River	Scriver Creek	Idaho	50,000	1946
Flathead River	Hungry Horse	Mont.	172,000	1946
Snake River	Anderson Ranch	Idaho	30,000	1946
Sacramento River	Cresta	Calif.	68,000	1943
" "	Pulga	Calif.	80,000	1943
San Joaquin River	Red Mountain Bar	Calif.	15,000	1943
Sacramento River	Shasta No. 5	Calif.	75,000[1]	1944
" "	Keswick	Calif.	75,000	1944
Colorado River	Boulder	Ariz.-Nev.	2- 82,500[2]	1943
" "	Parker No. 4	Ariz.-Calif.	30,000[2]	1943
" "	Bulls Head	Ariz.-Nev.	90,000	1945
San Joaquin River	Pine Flat	Calif.	15,000	1945

[1] Addition of generating units at project now under construction
[2] Addition of generating units at existing project.

Tested and Approved Good Housekeeping Institute

SEAL OF APPROVAL GOES TO ELECTRESTEEM

GOOD HOUSEKEEPING MAGAZINE AWARDS COVETED HONOR TO ELECTRIC STEAM RADIATOR



The Electresteem Radiator

New York, Aug. 1—The Good Housekeeping Institute today announced that the Electric Steam Radiator Corporation, of Detroit, Michigan, manufacturers of the Electresteem portable electric steam radiator, had been awarded the Good Housekeeping Seal of Approval.

Statement by President

Mr. Roy R. Fisher, president of the company, issued the following statement: "We are proud of the Good Housekeeping Seal, which adds the approval of that organization to the recognition previously accorded Electresteem by the famous Underwriters Laboratories. The Electresteem, which started as a dream, sold at first as a novelty, has now become an indispensable electrical appliance.

"We are embarking on an extensive sales promotion program backed up by advertising in several national magazines. This fall more than ever, Electresteem will be a great profit item for every dealer."

For information and trade prices write

ELECTRIC STEAM RADIATOR CORP.

6188 12th St. • Detroit, Michigan

FPC URGES ADDITIONAL DEFENSE POWER PROJECTS

In excess of 5,000,000 kw. of new generating capacity for the Western states for the years 1943-46 inclusive is proposed in a power development program submitted to the President by the FPC. The expansion program is based upon anticipated national power requirements of 63 million kw. by 1946 on the theory that a defense load of 20 million kw. may be expected when national defense expenditures reach the astounding figure of $3 billions per month.

FPC's recommendations are based upon the asserted necessity of ordering now the generating equipment that will be required so that there will be no interference with defense production. It calls for the annual installation of 2,500,000 kw. of steam and 1,000,000 kw. of hydro capacity. It proposes that the hydro be installed by the USBR, the Army Engineers or TVA.

Important aspect is the recommendation that FPC be given "authority to supervise the plan" and to make arrangements for the disposition of any new power built by the government.

Included in the program are the recommended Western steam plants in the accompanying table. Also listed are the hydro projects proposed.

More Salt Lake City Street Lighting Is Approved

A major step in the program of modernizing its lighting, the Salt Lake City Commission has approved a contract with the Utah Power & Light Co. calling for installation of 235 ultra-modern incandescent street lamps to replace old type arc lamps.

The contract calls for immediate installation of 77 6,000-lumen lamps on East South Temple St. between State and University, replacing 39 arc lights; 28 6,000-lumen lights on South Main St. between 5th and 9th South St.; 130 4,000-lumen lights in the area bounded by South Temple, State, Fourth South and 13th East St.

● To cut down the toll of accidents on one of Utah's most dangerous highway intersections, officials of Sandy, Utah, have approved the installation of four sodium vapor lights on U. S. Highway 91 in the Sandy business district.

● Eugene Water Board has been supplying Bonneville with approximately 2,000,000 kw.-hr. per month over the line built originally with the idea of transmitting Columbia River power to that central Oregon city. The power comes from the city's hydro and steam plants.

WESTINGHOUSE supplies the answer

Westinghouse CL-40 fixtures provide abundant light for seeing and selling in the showrooms of this large West Coast food and liqueur importer.

FLUORESCENT LIGHT for seeing and selling

Ceiling-mounted fluorescent luminaires provide inviting light for seeing and selling in the showrooms of this large West Coast food and liqueur importer.

Vertical display cases as well as office desks needed high-intensity, diffused illumination. Dark mahogany ceilings and walls, however, added to an already difficult lighting problem presented by varying office and mezzanine mounting heights.

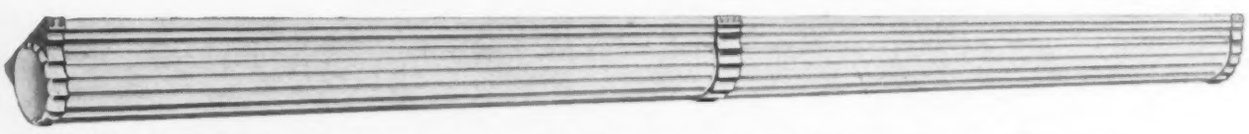
To "supply the answer," the mezzanine display cases were lighted with Westinghouse Type CL-40 luminaires spaced nine feet apart along the ceiling. Evenly distributed light on the office desks was also provided by six runs of these continuous strip units. The whole lighting system functions as a single light source; minimizing shadows and annoying glare.

Westinghouse engineering experience, as used in this West Coast installation, is available to help you solve your own lighting problems, too. Ask your nearest Westinghouse Lighting Distributor today for descriptive fluorescent folder F-8504; or, write Westinghouse Elec. & Mfg. Co., Edgewater Park, Cleveland, O.

★

Type CL-40 continuous strip luminaires are designed specifically for ceiling mounting. The units, used either individually or in continuous runs, provide high efficiency, cool, glareless illumination for all types of commercial establishments.

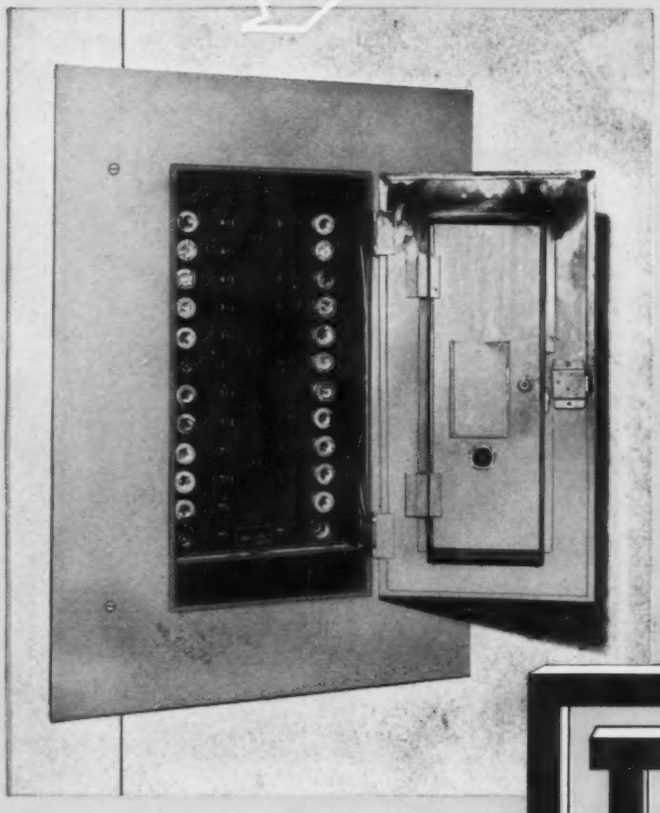
★



117 Westinghouse Electric Supply Company offices and independent Lighting Distributors provide local stocks and services.

Westinghouse LIGHTING EQUIPMENT

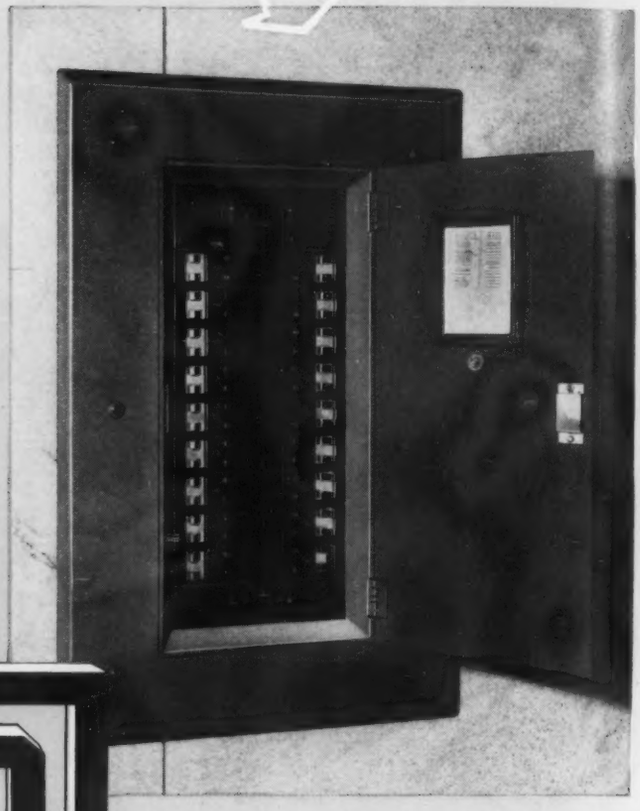
Here was the Problem



HOW TO PROVIDE MORE CIRCUITS AND GREATER CAPACITY IN AN OVER-LOADED WIRING SYSTEM

A Mid-western Public Utility Company was confronted with this problem of inadequate circuit capacity in its own office building. The old 24-circuit panelboards were running hot. Voltage drop was excessive with consequent reduction in light output. 300-watt lamps were insufficient but nothing larger could be used on the overloaded circuits. The fused lighting panel shown at left above was one of several replaced.

Here is the Answer



THIS NEW MULTI-BREAKER PANEL, INSTALLED IN THE SAME BOX, PROVIDES 50% MORE CIRCUITS . . . . . .

Square D Multi-breaker panelboards and the new thin wall wire were installed in the existing panel boxes and conduit. A 50% increase in the number of circuits was obtained because 36-circuit Multi-breaker panels could be fitted into the old boxes which formerly contained the 24-circuit fusible panels. A rearrangement of the wiring system permitted the satisfactory use of 500 and 750-watt lamps in the old fixtures.

Multi-breaker lighting and distribution panels, when installed in existing panel boxes, increase the number of circuits as much as 50% and provide circuit breaker protection. Thus, they solve a problem which exists in scores of commercial and industrial buildings.

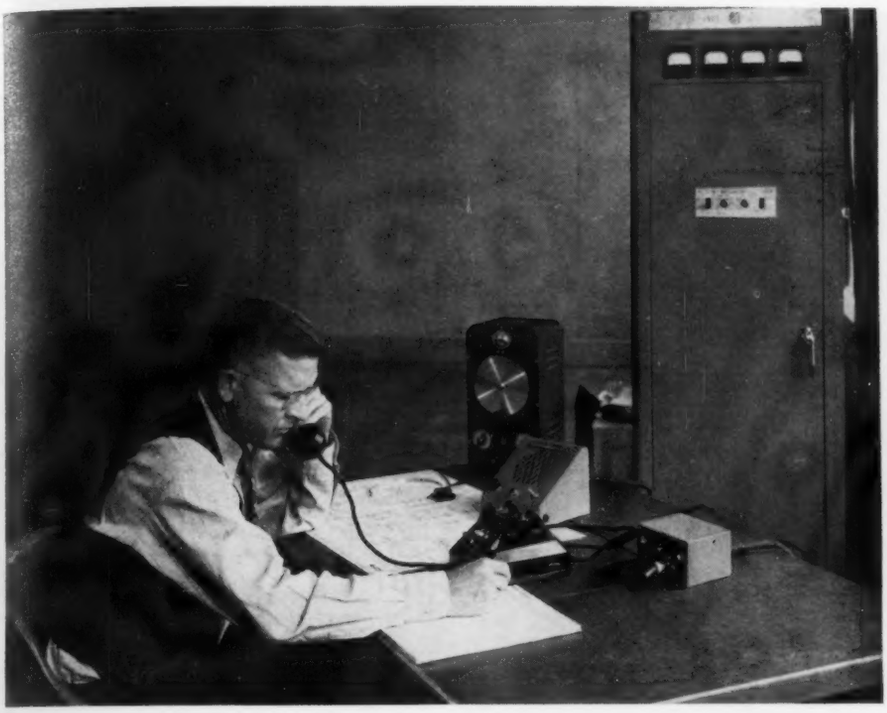
CALL IN A

SQUARE D COMPANY

LOS ANGELES - MILWAUKEE - DETROIT

IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO

SQUARE D MAN



San Diego G&E Installs Short Wave Radio Station

As a contribution to national defense, and improve speed and efficiency of repair service, the San Diego Gas & Electric Co. has installed a two-way short wave system for communication with emergency trucks. The 250-watt station, W6XEP, is the frequency modulation type of static-less broadcast, first of its type on the Pacific Coast. Three trucks have already been equipped with 25-watt sets and others will follow shortly, according to E. D. Sherwin, general superintendent of the company. The new station will cover a radius of 50 miles, and employ a special antenna, designed by company experts, 115 ft. high. Time involved in getting in touch with a repair crew in event of accident or sabotage is cut to a minimum, as trucks will be stationed strategically along transmission lines.

● THIRTY-SECOND public power body to sign a contract for Bonneville power is the Yakima County (Wash.) PUD which executed a contract for 2,500 kw. last month. The district is not operating but hoped that it would be in a position to start distribution of power in 1942.

● UTILITIES in New Mexico are preparing to come under the jurisdiction of the newly created Public Service Commission which will administer the Utilities Control Act passed by the last legislature. First commission meeting was held July 21. Heretofore home rule regulation was in force in the state.

● AIEE, at its annual meeting in Toronto, elected David C. Prince, of General Electric Co., Schenectady, president for the year beginning Aug. 1, 1941. Among the new vice presidents also named were three from the West, Arthur L. Jones, General Electric Co., Denver; Walter C. Smith, same company, San Francisco; and as a director, Lester R. Gamble, Washington Water Power Co., Spokane. Among holdover officers on the directorate will be Royal W. Sorensen, retiring president, California Institute of Technology, Pasadena; A. LeRoy Taylor, Univ. of Utah.

● AN EXPENDITURE of $23,600 will be made by the City Light Department, Seattle, on lighting Fourth Avenue South and East Marginal Way from Airport Way to the city limits. Defense plants in that section make this street extremely congested.

● NEVADA-CALIFORNIA ELECTRIC CORP. has changed its name to California Electric Power Co., as 85% of the company's business is in California in Mono, Inyo, Kern, San Bernardino, Riverside and Imperial counties.

● FORTY MILES of rural lines costing $35,000 will be constructed in the vicinity of Tucson, Ariz., by the Tucson Gas, Electric Light & Power Co., according to Max A. Pooler, general manager.

● TRIAL of the San Francisco Electrical Contractors Assn. of anti-trust charges has again been deferred at the request of the government attorneys until November.

MEETS EVERY DEMAND . . . AT LOWER COST

The all-important tensile strength that steel alone provides . . . the ruggedness to withstand vigorous punishment . . . the ability to outlast normal needs . . . are combined to the highest degree in *Crapo* Galvanized Steel Strand.

Definite economies both in construction and maintenance are made possible by this time-tested product. Its comparatively low initial cost, its workability in the field and its consistently trouble-free performance in service are significant reasons for its selection by engineers for the more important construction jobs.

The extra-durability of *Crapo* Galvanized Steel Strand is directly traceable to its heavy, ductile, tightly-adherent zinc coating, applied by the *Crapo* Process of galvanizing, and to the care and precision of manufacture. Every size and grade of *Crapo* Steel Strand is produced from selected steel, uniformly processed and laboratory tested to insure close adherence to required standards.

Crapo Galvanized Steel Strand is readily available in all standard grades and sizes from representative jobbers throughout the country. Consult the distributor of *Crapo* Galvanized Products near you, or write direct for further information!

INDIANA
STEEL & WIRE CO.
MUNCIE, INDIANA

Western Market Indices

Vital to the full-blast defense program is lighting, for 24-hr. construction, industrial plant illumination and protection. Now, with plane production booming, flying fields for training and bases are on the first order of business—and lighting contracts are contributing importantly to this program. New fields just begun include Stockton, Sacramento and Merced, averaging $800,000 each with lighting costs of approximately $25,000 each; a new $4,000,000 flying school at Merced, all in central California. Other fields, from Wenatchee, Wash., to Phoenix, Ariz., are maintaining this $25,000 lighting average. (For complete story on airport lighting, see feature story of this issue of ELECTRICAL WEST, starting pg. 31.)

Stocks

Western stocks, of prime concern, are holding up in fair shape except in steel conduit fittings of all kinds. Prices are steadier, with scattered advances in schedule, condulet and other staple lines, but a prospect of 5-10% increase in various steel conduits, because of prevalent all-rail stock replacements is considered likely. Predictions are that the stock pinch will be perceptible by September.

Defense and Private Construction

A general observation indicates no slackening in defense spending, one local example being the near-certainty of an additional $100,000,000 appropriation for Pacific naval bases, with a high proportion of electrical equipment. Private building has responded to the activity with a 10% increase over 1940 on the Coast. Industrial developments include an Oakland, Calif., branch plant and warehouse for International Harvester; a projected $10,000,000 magnesium plant at Las Vegas, Nevada, near the mines; and a $300,000 San Francisco printing plant. Municipal housing projects cover 400 dwelling units costing $1,200,000 and 295 units costing $1,302,000, both in Los Angeles. School and college construction includes a medical building for the University of California; dormitories for University of Arizona; structures at Bellingham and Renton, Wash., a group of schools averaging $400,000 in the S. F. Bay Region; and large proportion of successful bond issues for future work. Other housing projects include $700,000 for Spokane, Wash., $600,000 for Alameda, Calif., $1,500,000 for 500 units in Seattle.

Government orders to plane factories run $94,000,000 to Lockheed; $45,000,-

Answer to "Who Am I?"

H. H. "Kelly" Courtright. (See page 64 for quiz.)

Electriquiz Answers

1. True. In most utilities the annual salaries paid major executives seldom exceed 3c per customer per month.
2. False. Electricity has raised the standard of living.
3. True. Furthermore, in April, 1938, inter-connected in a unified system for a brief period were the Los Angeles Bureau of Power and Light, Southern California Edison Co., PG and E, California-Oregon Power Co., Mountain States Power Co., Sierra Pacific Power Co., and California Electric Power Co. (formerly Nevada-Calif. Electric Corp.) The latter's lines reach into Mexico.
3. False. Any wiring method permitted by the National Electric Code may be installed under the Uniform Electric Code in residential structures.
5. True.
6. True, according to the Federal Power Commission.
7. False. Measurement of water content of snow as well as depth is necessary for accurate prediction of water run-off.
8. False. A volt is a unit of electro-motive force or pressure.
9. True. California electrical rates are approved by the California Railroad Commission, a branch of the state government.

THERE ARE "BESTS" IN EVERY INDUSTRY

IN ELECTRICAL APPLIANCES IT'S

Sunbeam

Automatic MIXMASTER
Double Automatic IRONMASTER
SILENT AUTOMATIC TOASTER
Automatic COFFEEMASTER
SHAVEMASTER
FLAT TOASTER • FAN HEATER
GLASS COFFEE MAKERS
WET-PROOF HEATING PAD
MASTER PLUG & CORD SET
WAFFLE BAKER

MADE AND GUARANTEED BY
CHICAGO FLEXIBLE SHAFT COMPANY
5600 West Roosevelt Road, Chicago, Illinois
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224 S. W. Temple Street, Salt Lake City, Utah
557 Market Street, San Francisco, Calif.
50 YEARS MAKING QUALITY PRODUCTS

Sell PORTABLE ELECTRIC HEAT FOR GREATER FALL PROFIT

Feature this fast selling, long profit line for fall—Attractive, Dependable, Modern, Economical—and needed in every home...Order from your jobber NOW!

Seven Leaguer, (LP 131) weighs 14½ lbs. has extra long cord for easy moving throughout home. Attractive finishes in morocco brown or ivory. 1320 watts, 120 volts, A.C. or D.C., Height 39½ in. Base Diameter 10 in.

Spred-Ray (MP 121) radiates heat in large arc. 1250 watts, 120 Volts, A.C. Chrome Top, duotone brown base and grille. Equipped with 6 feet of cord and spring action plug. Height 17½ in., Width 10 in., Depth 10 in.

Heat Fan (HF 161) Warms in winter, Cools in summer—Available in white or morocco brown. 1650 watts, 115 volts, Height 11⅞ in., Width 9¼ in., Depth 5⅝ in.

THERMADOR 5119 So. Riverside Drive Los Angeles, California 230 Madison Street Oakland, California

000 to Douglas and $26,000,000 to Vega. Backlogs of $31,619,280 to Vultee and $16,287,134 to Northrup are also ordered. An army ordnance plant at Hermiston, Ore., will take $3,145,841 and an army flying school at Lemoore, Calif., $1,849,949. Electrical drydock equipment at Mare Island, Calif., will require $54,275. Antenna system for Hamilton Field, Calif., $20,900.

Miscellaneous Orders

Prospective heavy machinery orders include equipment for Parker dam powerhouse, covering $367,700 Westinghouse generators, $102,000 Moloney transformers, $26,717 Kelman circuit-breakers, $4,898 Memco disconnect switches, and $5,325 Westinghouse arresters. Railway and Industrial Mfg. Co's. bid of $153,800 was low on disconnect switches for Bonneville transmission system. Larger awards will be made shortly for three 108,000-kva. generators and three 150,000-hp. turbines for Grand Coulee; three 25,000-kva. transformers and two 25,000-kva. condensers for Bonneville; and four 3,333-kva. transformers for the city of Tacoma, Wash. Other miscellaneous orders of interest cover GE carrier current equipment costing $25,600 for Bonneville system; 5,000 headsets for a California prison; 1,500 red cedar poles for various 115-kv. lines in southern Oregon; a $266,521 award for GE distribution equipment for Bremerton Navy Yard. Low bid for Anderson dam and power plant, on South Fork of Boise River in Idaho, was $9,986,203. $342,850 went to S. Morgan Smith for 40,000-hp. turbine for Parker dam. Fifty kw. heaters for Grand Coulee powerhouse cost $13,872.

For the Record

Pacific Coast is scheduled to produce 210,000,000 lb. of aluminum in 1942, one-third of U. S. output. Coast lumber production is 99.1% of capacity. California factory payrolls are running 60% over 1940 with 37% increase in personnel.

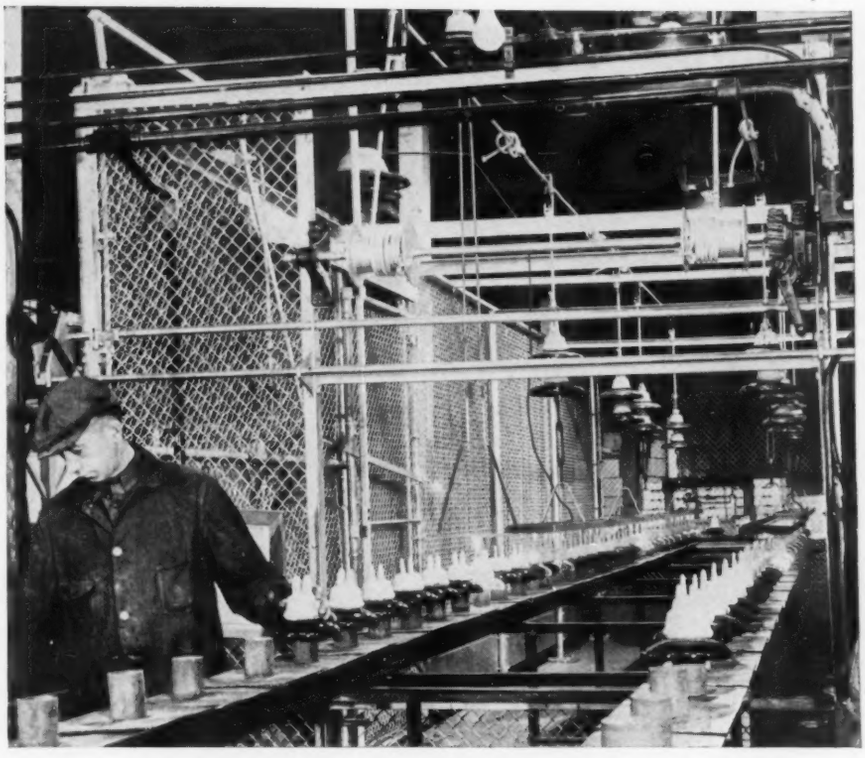
CONTRACTS

To Western Montana Electric Co., Missoula, Mont., $27,674.50 for 37.6 mi. of line serving Missoula Electric Coop., Inc.

To Max J. Kuney Co., Spokane, Wash., $108,950 for 57 mi. of line to serve the Lincoln Electric Coop. Inc. of Davenport, Wash.

To Utah Power & Light Co., Ogden, Utah, $32,950 for relocation of power lines, Construction Quartermaster's Hill Field.

C. H. E. Williams Co., Ltd., 509 Richards street, Vancouver, B. C., have secured the electrical contract in the new $56,000 plant for the Royal Canadian Air Force, now under construction at Prince Rupert, B. C.



Our Automatic "Lie Detector"

Every Victor Insulator that goes over this tester gets a workout which reveals the truth of its performance on the line . . . Every piece of porcelain, both before and after assembly, is searched for defects with a 200,000 high frequency test plus the sledge-hammer blow of the 60 cycle flashover. Should a puncture occur it is easily recognized and the insulator discarded. This practice saves Victor customers money by assuring them lasting and safe performance on their lines.

V The Mark of a GOOD Insulator

VICTOR INSULATORS, INC.
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San Francisco
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MAYDWELL & HARTZELL
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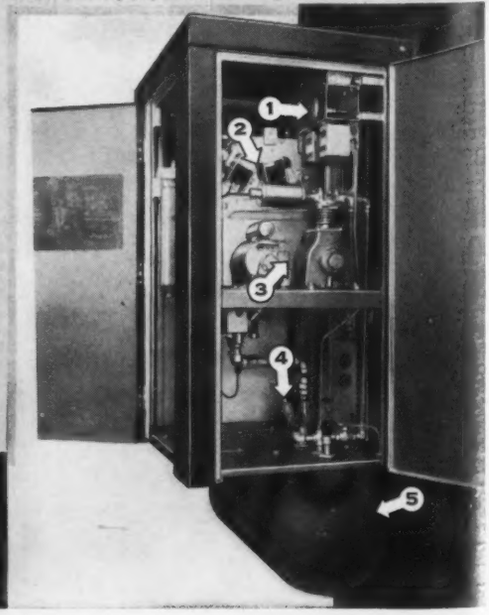
G.E. LEADS AGAIN by adding high-speed, low-energy operation to the many other advantages of these oil circuit breakers

PNEUMATIC operation means substantial savings in the cost of control leads and batteries, since only a few amperes are required for the intermittent load of the small compressor motor, the trip coil, and the control valve. It is available on all G-E oil-blast breakers up to 230 kv.

An adequate supply of air for dependable operation is maintained by the compressor and specially designed pressure switches. The air storage system has sufficient capacity for any standard operating duty cycle.

Consider pneumatic operation for your next breaker. Our local representative can provide information to help you decide—or write for descriptive leaflet GEA-3616. General Electric, Schenectady, N. Y.

A right-side view of the weatherproof mechanism housing with the doors open to show (1) the pressure control, (2) trip coil for positive tripping, (3) compressor equipment, (4) control and safety valves, (5) the air storage tank.



GENERAL ELECTRIC

859-2-7400

TRADE notes

FRESNO MERCHANT OPENS $50,000 STORE

Dealing principally in household furnishings, including draperies and floor coverings and interior decorating service and a large display of appliances and radios, a $50,000 store has been opened by W. R. Turpin in Fresno, Calif. Turpin has been in the retail appliance and furnishings business since 1912.

General Electric radio receiver sales organization will now be responsible for the sale of transmitter tubes, according to a statement by the company.

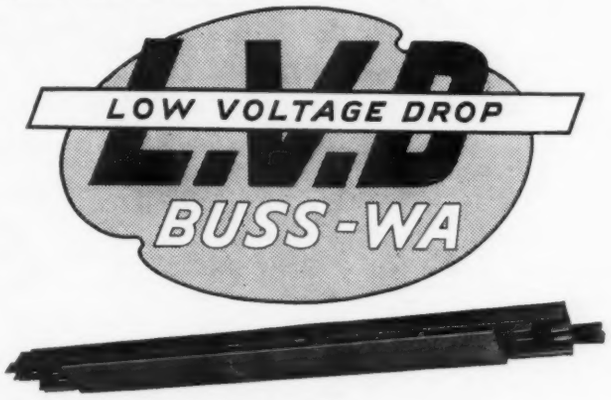
A downtown showroom, featuring displays of X-ray apparatus, has been opened on the ground floor of the Terminal Sales Bldg., Portland, Ore., by Westinghouse X-ray Division. Need for more adequate display space and offices prompted the move to the new location, according to H. D. Moreland, district manager.

● THE 1942 PHILCO radio line was introduced to more than 300 salesmen and dealers of the Strevell-Paterson Hardware Co., intermountain distributors, recently by T. A. Kennally, general sales manager of Philco, Philadelphia and Cliff Bettinger of San Francisco, west coast division sales manager for Philco. G. A. Rogers, manager of the Strevell-Paterson was host.

● NICHOLAS & COOK has been dissolved as of July 1. Cook will continue to operate at 1063 Howard St. as the E. B. Cook Co., handling the following lines: Wheeler Reflector Co., incandescent and fluorescent reflectors; S. H. Couch Co., intercommunicating telephones; Clifton Mfg. Co., rubber and friction tape; Quality Glass Co., commercial lighting enclosing bowls; Perfeclight Co., commercial fixtures; Prime Mfg. Co., electric fence controllers. Fred Nicholas has opened new offices at 1123 Harrison St. as the F. M. Nicholas Co., with Bill Fields as his assistant. He is handling the following lines: M. B. Austin Co., wiring supplies; Penn-Union Electric Corp., solderless connectors and fittings; Ideal Commutator Dresser Co., motor maintenance equipment and tools; Great Western Fuse Co., renewable and nonrenewable cartridge fuses; Knox Porcelain Corp., knobs, tubes and insulators; Federal Electric Co., Signal Div., horns and sirens.

IS "CURRENT STARVED" ELECTRICAL EQUIPMENT KILLING YOUR PRODUCTION QUOTAS ?

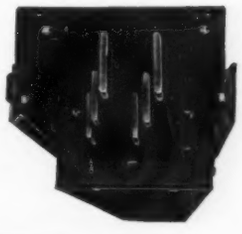
Adding a machine here and a welder there . . . opening up a new department . . . putting an extra load on this conveyor or that machine tool . . . these are some of the ways in which your plant may be approaching "current starvation" that cuts down efficiency all along the line. *Here's your answer.*



THE *New* TRUMBULL FEEDER DISTRIBUTION SYSTEM THAT PUTS ***MORE*** CURRENT TO WORK

New L. V. D. BUSS-WA can be installed QUICKLY, easily and at LOW COST to give your production lines ample power supply. Its uniquely engineered characteristic of LOW VOLTAGE DROP means that more of the power you buy goes to work on production . . . that every machine receives its full rated current for maximum output operation. L. V. D. BUSS-WA with its high interrupting rating insures consistency of selection with feeder protective devices of like high interrupting rating.

If you need increased electrical capacity or short circuit strengths . . . if your plant distribution system is not fully equal to top-speed demands . . . investigate L. V. D. BUSS-WA . . . the ultimate in design of low voltage enclosed bus bar distribution systems, combining the *flexibility, salvability, low maintenance* and other time and money saving features of the Trumbull Feeder Distribution System with an entirely new order of electrical efficiency. *Write for Circular No. 335.*



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THE TRUMBULL ELEC. MFG. CO. PLAINVILLE CONN. U.S.A.

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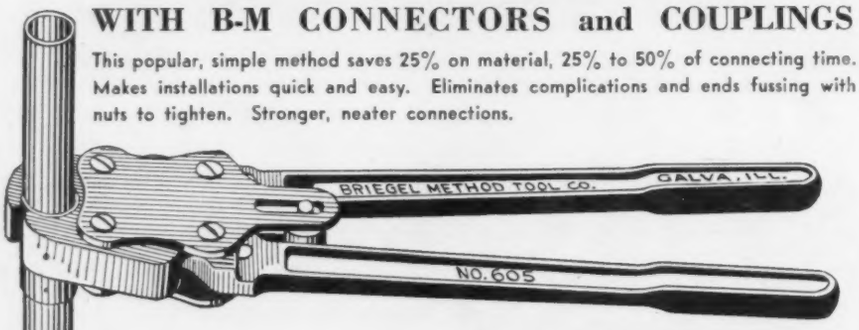
Factories at SEATTLE — SAN FRANCISCO — LOS ANGELES

TELESCOPE BM SYSTEM

MORE PROFIT AND LESS TIME ON EVERY INSTALLATION

WITH B-M CONNECTORS and COUPLINGS

This popular, simple method saves 25% on material, 25% to 50% of connecting time. Makes installations quick and easy. Eliminates complications and ends fussing with nuts to tighten. Stronger, neater connections.



Only One Tool Needed!

Costs you only $1.25 for the patented B-M indenter (½" size handles 80% of all installations). Just two squeezes, and you have a smooth, neat connection. No other tools required. This tool can save you many times its cost on the first job.

DISTRIBUTED BY

The M. B. Austin Co. Chicago, Ill.
The Steelduct Co. Youngstown, Ohio
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Enameled Metals Pittsburgh, Pa.
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General Electric Co. Bridgeport, Conn.
Triangle Conduit & Cable Co. Elmhurst, New York City

APPROVED BY UNDERWRITER'S LABORATORIES

Strong, Neat Connections

You welcome the speed and ease that the B-M system puts in your hands. These fittings give you complete, well finished work in a hurry—(not water-tight).

BRIEGEL METHOD TOOL CO., Galva, Ill.

GEO. E. HONN CO.

420 Market St. San Francisco, Calif.

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—LOW VOLTAGE GENERATORS
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Give You Greatest Flexibility in Floor Box Applications

A floor outlet for any type of floor construction.

LEW Floor Boxes and Fittings manufactured since 1930 are credited with being the finest made.

A TRIAL WILL CONVINCE YOU

Complete stock carried in Western Warehouse

CALL or WRITE

Walter E. Brand Co.
1855 Industrial St., Los Angeles, Calif.

Lew Fittings Co.
630 W. Jackson Blvd., Chicago, Ill.

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Pioneers of Lighting in the West

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G. S. SPANGLER 618 Colorado Bldg., Denver, Colo.

PEOPLE

made this news

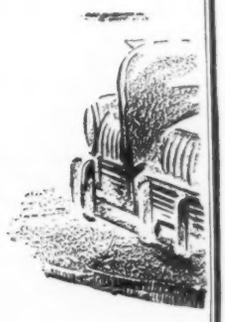
PGE "STREAMLINES" GENERAL SALES DEPT.

Portland General Electric Co. has moved the dealer promotion division and home economics section in with the general sales department of PGE on the seventh floor of the company's head office—as a movement to "streamline" the department, according to A. C. McMicken, general sales manager.

A. H. Greisser has been appointed assistant general sales manager, and five divisions have been set up under direction and supervision of working supervisors: *Power sales division*, J. D. Scott, working supervisor and reporting to him power sales engineers A. L. Apperson, K. B. Arnett, C. W. Brissenden and T. W. Fitch, illumination engineer. *Commercial sales division*, H. S. Johnson, working supervisor and reporting to him commercial sales representatives, R. O. Adams, L. J. Collins and A. N. Hoss. *Residential sales and dealer contact division*, J. M. McKay, working supervisor and reporting to him district representatives G. G. Geddes, H. A. Joslin, P. J. Kavanagh, R. R. LaMar, G. W. Mason; sales assistants, E. J. Bratney, F. G. Buchtel and J. L. Day. *Dealer promotion division*, G. W. Madison, working supervisor and reporting to him Lloyd Mead, dealer promotion representative and home economists Phoebe Gillam, director, Thelma Brown and Dorothea Rolfsness. *Clerical Division*, W. E. Hudleson, chief clerk and reporting to him are E. W. Bruce, clerk, E. J. Bratney, part time clerk and stenographers Nellie Hart, Edna McKee and Helen Willis.

Though the dealer promotion and home economics section have their offices on the seventh floor, they will continue to use the electric kitchen on the second floor for demonstration purposes.

● VICTOR W. HARTLEY, managing director of Pacific Coast Electrical Bureau, Los Angeles, was appointed to the board of governors of the International Assn. of Electrical Leagues to represent the far West, filling a vacancy made when George Barker, manager, Northern California Electrical Bureau was called to the army.



Working together for Defense!

Teamwork all along the line is vitally essential in this time of national emergency. Whether the job is one of keeping open the line of traffic and communication, or of keeping an endless flow of equipment and materials streaming from production lines—the task calls for the best efforts and cooperation of all.

Roebling believes that it can best do its part, despite the unremitting pressure of emergency demands, by unceasingly maintaining the high standard of quality for which Roebling Electrical Wires and Cables are noted—a standard of quality that is an assurance of safety and all-around dependable service.

JOHN A. ROEBLING'S SONS COMPANY
OF CALIFORNIA

San Francisco Los Angeles Seattle Portland

ROEBLING
ELECTRICAL WIRES AND CABLES

Time Saver FOR Busy People

BANK WITH US BY MAIL

You don't waste time running around to every store to pay your bills . . . you just mail your check. Then why don't you save additional time and trouble in handling your bank affairs by using our Bank-by-Mail Service? It's the same idea. Write today for simple instructions for banking by mail.

CROCKER FIRST NATIONAL BANK
OF SAN FRANCISCO
California's Oldest National Bank

Member Federal Deposit Insurance Corporation

Speed Up ANCHORING JOBS ★

EVERSTICK ANCHORS...

Speed and ease of installation are features that crews and engineers appreciate in Everstick Anchors. Nut housing locks, anchor firmly on rod—entire unit is installed and expanded in a minimum of time. *Write for new bulletin.*

EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

Plumb, Taylor Honored By AIEE

Dr. H. T. Plumb, General Electric Co., Salt Lake City, and Dr. A. Leroy Taylor, dean of the school of mines and engineering at the University of Utah, have been made Fellows of A.I.E.E., a signal honor of the Institute. Dr. Plumb was graduated from Milton College and the University of Wisconsin. He taught electrical engineering at Pratt Institute in New York City and Purdue University, Ind. On leaving the educational field, Dr. Plumb joined the General Electric Co. as an engineer and consulting engineer. Dr. Taylor was graduated from the University of Utah and the University of Michigan and has done graduate work at Stanford University. He was employed by the General Electric Co. at Schenectady from 1910 to 1911. In 1911 he joined the University of Utah faculty as an instructor in electrical engineering and, except for two years, 1912 to 1914, when he managed a contracting firm, he has been with the school. Taylor was made dean of the school of mines and engineering of the University in 1939 and he has been secretary and chairman of the Utah Section, A.I.E.E. and student branch counselor.

● CLYDE H. WOOD of Seattle, Wash., has been named manager of the Agency and Specialties Division, Westinghouse Electric & Manufacturing Co., for the Pacific Coast district. Wood, a native of Seattle, graduated from Washington State College in 1929, and joined Westinghouse the same year, serving in Pittsburgh and Indianapolis before his transfer to the Seattle office in 1937. Ralph H. Coburn, who has had charge of the work of the division in the Salt Lake City office, succeeds Wood in Seattle. Coburn, a graduate of West Virginia University, joined Westinghouse in 1936.

● W. A. HUCKINS, sales manager for the Utah Power & Light Co., directed the recent campaign of the USO in Salt Lake City. Elias J. Strong, manager of the Electrical League of Utah, acted as a major.

● FRANK MCLAUGHLIN, president of the Puget Sound Power & Light Co., Seattle, has been named a member of a board of six trustees appointed by the Pacific Advertising Clubs' Assn. to supervise advancement of a business program of the association designed to promote better understanding between business and consumer in the Western states.

● ROBERT NEUMAN, a 20-year veteran of Nevada-California Electric Corp., as superintendent at San Bernardino, has left the company to enter the U. S. Navy as a Lieutenant stationed at San Pedro. Neuman will be succeeded at San Bernardino by Paul Yelton, who will receive his Nev-Cal 20-year button in November, and has been superintendent at Victorville since 1932. Frank Lucking has been transferred from Barstow to Victorville, after serving at the former location for eight years, and W. L. Bennington, who has been at the Riverside office for the past two years and recently temporarily at Randsburg, becomes acting superintendent at Barstow. Mrs. Esther Bennington joins her husband at Barstow and will serve the Barstow, Victorville and Randsburg area as home economist. Mary Grant will take care of the home economist services in the Riverside district.

● ALTHOUGH IN THE SERVICE, L. M. Watson, Westinghouse Electric & Mfg. Co., Los Angeles, was elected chairman of the Southern California Section, Illuminating Engineering Society. Foster K. Sampson, Southern California Edison Co., retiring president, becomes secretary. On the board of managers are: H. C. Barnard, A. M. Johnson, Joseph J. May, O. W. Meissner and W. H. Robinson, Jr.

● THOMAS F. PETERSON has been appointed Director of Electric Cable Engineering and Research of American Steel and Wire Co., subsidiary of U. S. Steel Corp. His office will be located at the company's headquarters in Cleveland. Peterson received his masters degree in electrical engineering at Leland Stanford University, Calif.

● WILL O. SMITH, sales manager for General Electric Supply Corp. in Salt Lake City, addressed members of the Utah Sales managers association at their final meeting of the spring season.

● DAVID HALL, an engineer for Westinghouse Electric & Mfg. Co. since 1908, has been appointed assistant to the Pacific Coast engineering and service manager, with headquarters in Los Angeles. Hall graduated in electrical engineering from Lehigh University in 1896. From 1910 to 1926 he was in charge of the direct current section of Westinghouse power engineering division at East Pittsburgh. In 1926 he was named manager of the engineering division at Los Angeles, and served as such until his recent promotion.

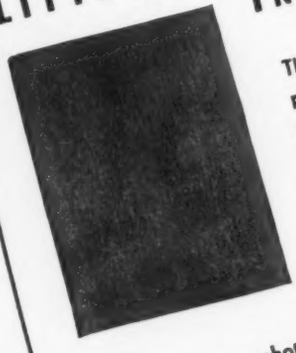
KIDS KNOW A THING OR TWO

RIGHT WRONG

WHEN a kid makes a sling shot he picks out a good solid crotch. No one ever told him about grain structure, but trial and error has taught him this lesson. The illustration above demonstrates in a simple way, the application of this principle. Specify BTC, Drop-Forged Hi-Line Hardware.

THE BREWER-TITCHENER CORPORATION
CORTLAND, N. Y.

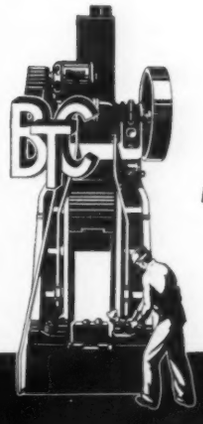
LITTLE LESSONS IN FORGING . . .



The illustration to the left is a photomagraph of the grain structure in a forging billet. Notice the distinctive straight grain in this metal.

To the right is a photomagraph of a piece of BTC Hi-Line Hardware. Notice how the grain flow has been controlled, and gives a perfect example of strength at all points—a direct comparison with the sling shot.

FORGERS OF HI-LINE HARDWARE



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YOU KNOW WITH A FORGING

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Made only by **DRIVER-HARRIS COMPANY**

Stocked for the Coast Trade at

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THE POPULAR TIME SWITCH LINE KNOWN EVERYWHERE

NOW—lower prices and higher capacities

There is a Tork Clock for every regular switching job; 60 minute, 4 hour or daily cycles.

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Pittsfield, Mass.

ELECTRICAL TESTING LABORATORIES

Electrical Photometrical, Chemical and Mechanical Tests. Inspection of Materials and Apparatus at Manufactory.

2 East End Ave. New York

CLASSIFIED SECTION

WANTED TO BUY

2 Transformers—25 or 35 KVA.—54 KV. or 66 KV.—6600 V. or 2300 V. in good condition.

THE RED RIVER LUMBER CO.
WESTWOOD CALIFORNIA

WORKS MANAGER

With wide and varied experience in the latest methods of mass-production in electrical and mechanical engineering, used to handle harmoniously a large body of help, strong in rapidly increasing production, now employed. University graduate. PW-51, Electrical West, 520 North Michigan Ave., Chicago, Ill.

● V. L. BOARD has been appointed district manager of one of the six new field offices of the Priorities Division, OPM. Board, an electrical engineer, is a graduate of the University of Missouri, a Fellow of the American Institute of Electrical Engineering, a member of the Denver Planning Commission and chairman of the Industrial Development Committee of the Denver Chamber of Commerce.

● R. RAY LEGG, former Western Sales Manager, of the Nash-Kelvinator Corporation succeeds Charles T. Lawson as Sales Manager of Household Appliances for that company. Don Rulo, formerly of the Kelvinator Division executive staff, will become Western Sales Manager.

WILLIAM B. HIMROD, vice-president of the Los Angeles Board of Water and Power Commissioners, has resigned because of the demands of private business. He is senior partner in the law firm of Himrod and Parks. He was appointed to the commission by Mayor Fletcher Bowron on May 17, 1939, for a term which would have extended to July 1, 1942.

● WILLIS E. SULLIVAN of Boise, Idaho, has been appointed assistant attorney for Idaho Power Co. A graduate of Stanford and Harvard law schools, Sullivan has been practicing law in Boise.

● JAMES L. FAHEY, district operating manager for General Electric Supply Corp. in Salt Lake City, has been elected president of the Salt Lake City Jr. Chamber of Commerce. Fahey served as chairman of the U. S. Jr. Chamber of Commerce Christmas Lighting Committee during 1940.

● A. L. HUGHES, electrical contractor in San Francisco for 50 years, retired Aug. 1, with a sigh of relief. Declaring himself free of defense priority, labor shortage, tax raise, price control and government troubles, "Pop" Hughes said he never wanted to see anything electrical again.

● HARRY H. KRUEGER, superintendent of power for the Utah Power & Light Co., was named chairman of the Utah section, AIEE, at the organization's annual meeting held recently. Other officers installed were William N. Grooms, National Equipment Co., vice-chairman; John A. McDonald, General Electric Co., secretary-treasurer; Wallace E. Grovers, T. A. Robinson and James L. Schricker, executive committeemen.

NOTED NORTHWEST EDUCATOR DIES

Dr. Carl Edward Magnusson, dean emeritus of the University of Washington, died in Seattle, Washington, July 10. Dr. Magnusson attended the University of Minnesota for his bachelor and master degrees, and was awarded his degree of doctor of philosophy from the University of Wisconsin in 1900. He was professor of physics at the University of New Mexico and New Mexico School of Mines for several years, following which he went to the University of Washington in 1904 as associate professor of electrical engineering.

In 1906 he became full professor and was made head of the department. During 1911-12, Dr. Magnusson studied under Dr. Charles P. Steinmetz at the General Electric plant at Schenectady. An authority on electric power, he was a member of the first and third World Power Conferences, and the author of many electrical engineering texts.

● JAMES A. REARDON, retired electrical engineer of Seattle, died in that city recently, age 70 years. Born in Michigan, Mr. Reardon had lived in Seattle for 40 years, and for many years was actively engaged in private electrical practice.

● L. A. MORPHY, superintendent of stations of Northwestern Electric Co., Portland, and 19 years with that company, has resigned to accept the position of assistant superintendent of power of Pacific Power & Light Co., at Kennewick, Wash.

John Hooper who has been with the Northwestern Co. since 1920 has been appointed to succeed Mr. Morphy.

● H. W. DERRY, manager of the new industries department of the Pacific Power and Light Company, Portland, Ore., was the principal speaker of the third annual Inland Empire Manufacturers' show at Portland. Theme of the meeting was to focus attention on possibilities for industrial expansion and enlargement for new industries in connection with the defense movement.

● BERNICE REDINGTON, Northwest home economics expert, has joined the staff of the Pacific National Advertising Agency in Seattle. From 1926 to 1936 Miss Redington headed several radio cooking schools and since that time has conducted cooking schools up and down the Pacific Coast.

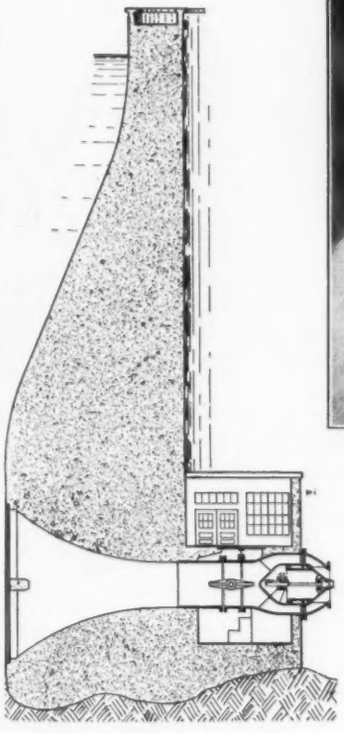
● HARRY P. DISBROW, chief clerk of the Graybar Electric Company in Seattle, was drowned in Lake Washington recently. He was 38 years old, and survived by his wife and one daughter.

● MELVIN L. ARNOLD, for the past six years associated with Jos. R. Gerber Co., a Portland advertising agency handling the Portland General Electric Co. account, has been appointed acting advertising manager for the company. While with the Garber Company, Mr. Arnold worked on the company account and prepared much of its advertising copy. He succeeds Ralph Millsap, who, holding a commission in the Naval Reserve, was recently ordered into active service at Annapolis.

● CLAUDE FOWLER, a member of the staff of electrical inspectors at Fresno, was appointed chief inspector of that city following the deaths both of C. T. Coyle, chief inspector and Mark Webster, acting chief.

● J. VERNON SHARP, manager of the Sharp Electric Co., was elected president of the Salt Lake City Lions' Club, June 6. Sharp was president of the Electrical League of Utah in 1939.

For Flood Control . . . Regulation of Stream Flow



Typical arch type dam section showing arrangement of conduit, butterfly valve and discharge regulator.

Pelton designed regulators of the Johnson (balanced plunger) type are utilized in most of the West's large scale water conservation, flood control and stream flow regulation developments, and have met the most exacting requirements of this service. They are smooth in operation at all openings and are easily manipulated through pilot valve control, of the main plunger. Units of this type have been built up to 10 ft. discharge opening, capable of 5800 c.f.s. under 250 ft. head.

The Pelton Water Wheel Company

Hydraulic Engineers

120 Broadway NEW YORK · 2929 Nineteenth Street SAN FRANCISCO · Paschall Station PHILADELPHIA

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PELTON

Subsidiary of THE BALDWIN LOCOMOTIVE WORKS

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PROFILES *of the month*

Congratulations

R. S. Overstreet (right) was congratulated on becoming ass't. gen. sales mgr., Idaho Power Co. by J. W. Crowe, Boise div.

Luau

Right, above: Luau for Elbert Kramer, Westinghouse sales application supervisor, who has been working in Hawaii, given by Bernard Young, Hawaiian Electric Co. Left to right: Virginia Kramer, B. Young, Mrs. Kramer, Kramer and F. C. Barnett, Westg.

Right: A. W. Robertson, chairman of the board, Westinghouse, has been inspecting Western power projects and visiting company offices in the Far West territories.

Visitor

Below, Trent German, lighting specialist, So. Calif. Edison Co., awarded gold 49'er pin for 49 plus footcandle jobs by W. H. Robinson, ass't. mgr., So. Pacific Division, G-E, at recent IES meet in L.A. Left to right: Lloyd Gates, Robinson and German. Miner Lou Hruby, G-E.

49'er Party

Preview of coming campaigns by

P·G·and E·

ELECTRIC APPLIANCE SOCIETY
OF NORTHERN CALIFORNIA

FOR NEXT MONTH—SEPTEMBER

A BRAND NEW PROMOTION on BETTER-SIGHT LAMPS

Featuring "A Lamp for Every Member of the Family — and Every Purpose"

Details are not yet ready for publication but we can promise you a bang-up advertising program complete with free dealer hand-outs, free display cards, free publicity story and picture service and other features still in the planning stage.

The next word will come in a bulletin from the Electric Appliance Society

Don't let it slip by—watch your mail carefully!

EW 108-841

DEALERS: By watching this page from month to month you can keep informed of sales promotional campaigns to be sponsored by the Pacific Gas and Electric Company and the Electric Appliance Society. Detailed information will be supplied, as usual, through the mail. If such information is not received, call our local office or write Electric Appliance Society, 1355 Market St., San Francisco, Calif.

BUILDING IS BOOMING
ADEQUATE WIRING IS TODAY'S JOB

The noise of a building boom resounds throughout the land. It is here and gaining momentum every day. Tomorrow each of these buildings will be somebody's home and will be a home for years.

Yet, unless each building is properly wired, it will be shut tight through all the future as a market for the goods of the electrical industry.

If the building boom is to mean a future market for us, we of the industry must see NOW that each of these new buildings is adequately wired. After the building is finished it is too late.

Wiring is one of the building items that must be SOLD. It hasn't the dramatic appeal of many things that go into a home—the things that sell themselves—the fancy tile work, colorful bathrooms, eye-appeal furnishings.

Our job is to make adequate electrical service more desirable to the home owner than any of these other attractive features. He must understand the wiring story. This story must be told by the man on the ground. In your territory you are more effective than any outside influence and it is up to you to sell the home owner the story of adequate wiring.

The limitations of your future are being established NOW, in every house that is built in your territory. Do your best selling job now, while building is in full swing.

Make every contact you have with the public count. Advertise and publicize wiring. Carry a line or more about wiring in every letterhead and billhead and every other public communication you send out. Talk, write, SELL ADEQUATE WIRING NOW.

PACIFIC COAST ELECTRICAL BUREAU

601 West Fifth St., Los Angeles • 447 Sutter St., San Francisco